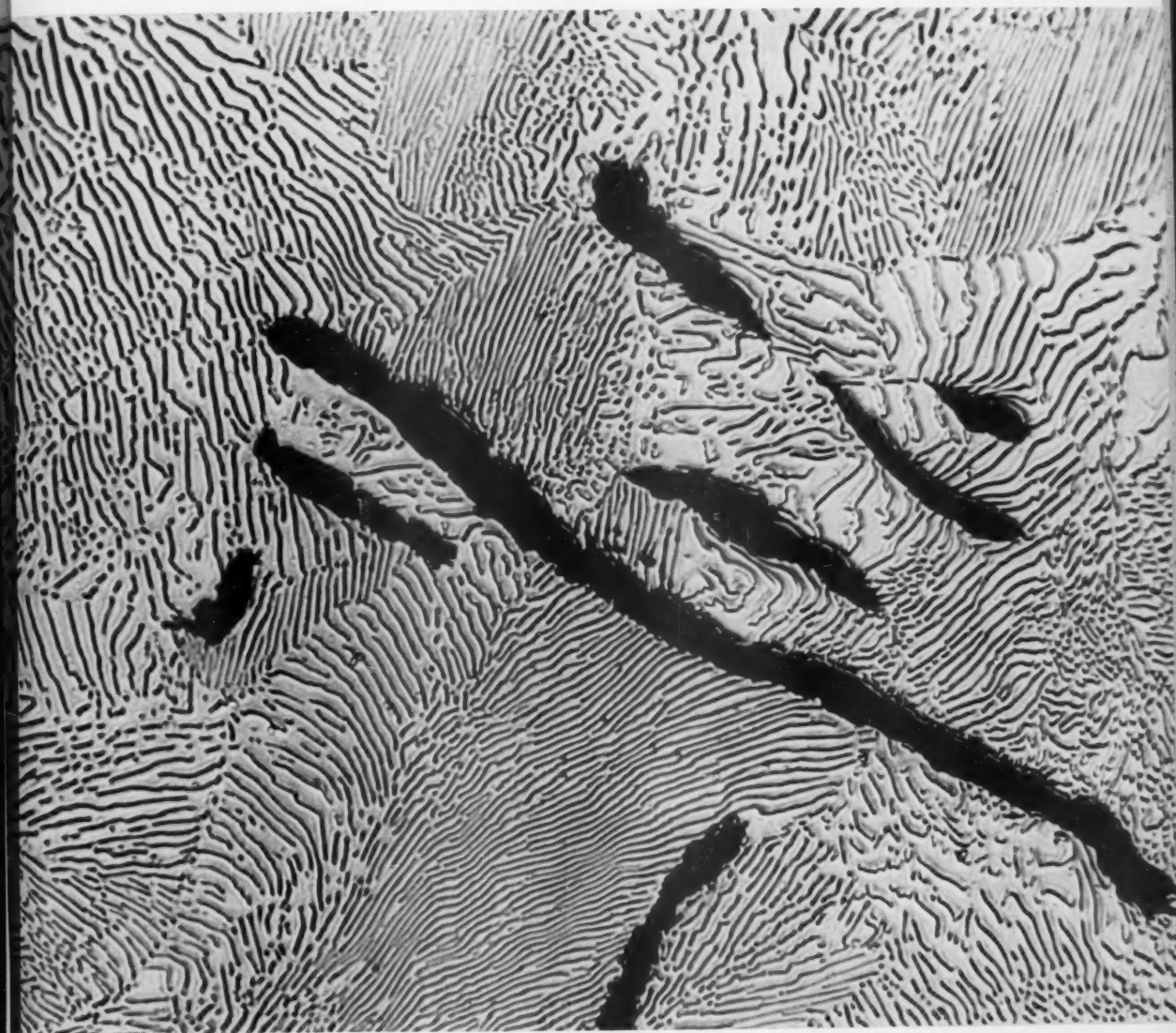


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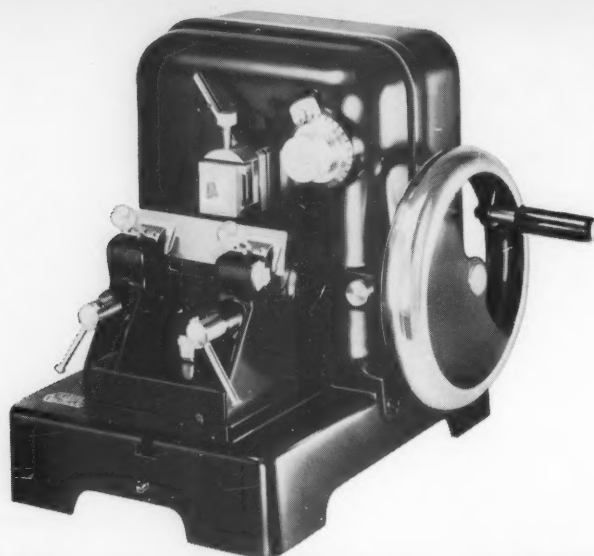
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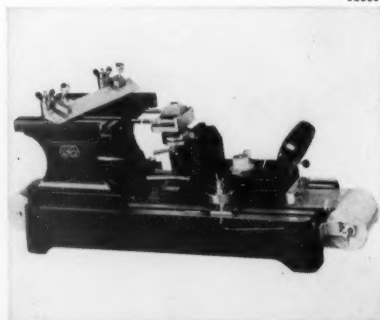
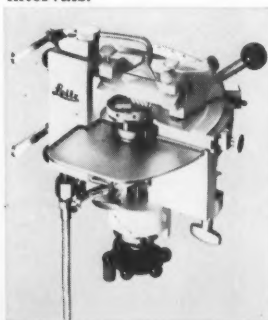
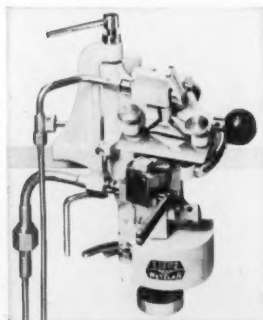
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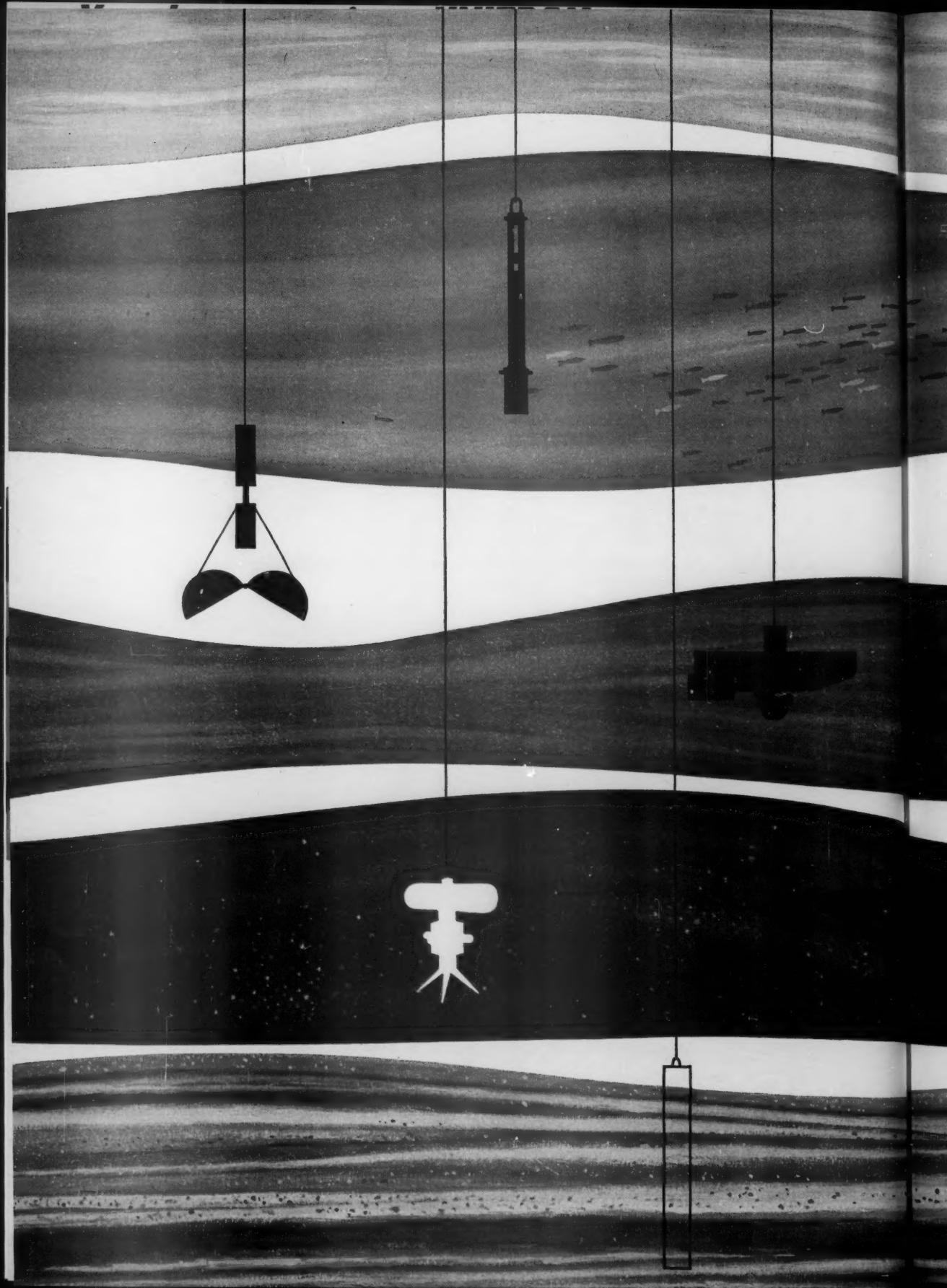
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Cover	Pearlitic structure of cast iron. The basic mass is coarse pearlite; the black stripes are graphite. Chemical analysis (in percent): carbon, 3.20; silicon, 1.20; manganese, 0.78; phosphorus, 0.28; sulfur, 0.04. [By courtesy of E. Leitz, Inc.]	





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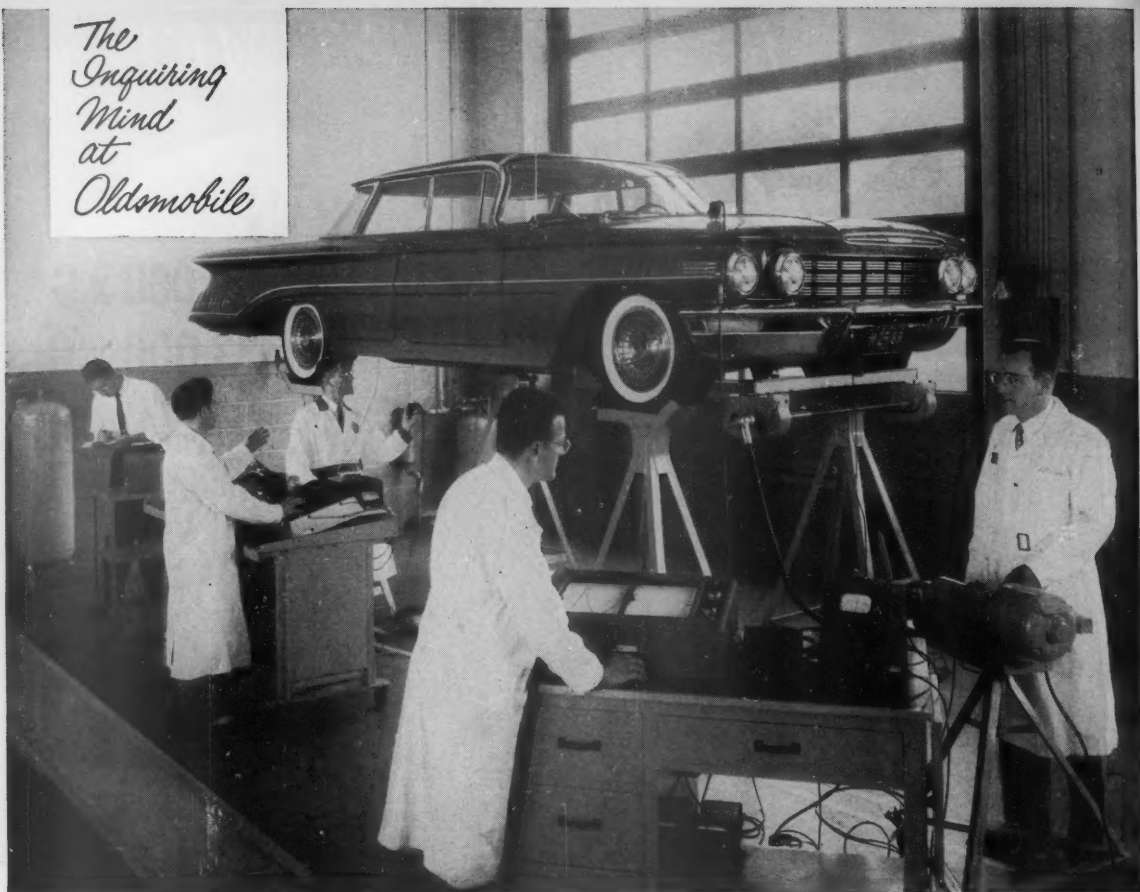
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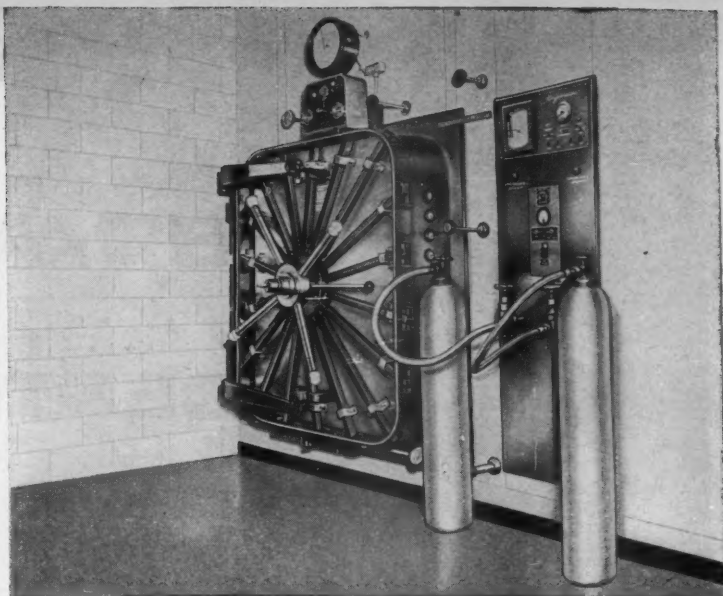
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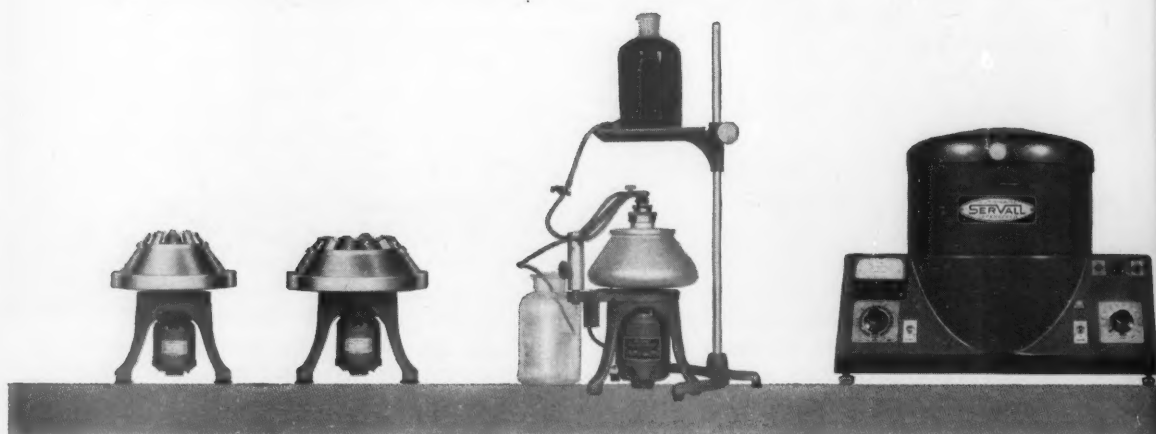
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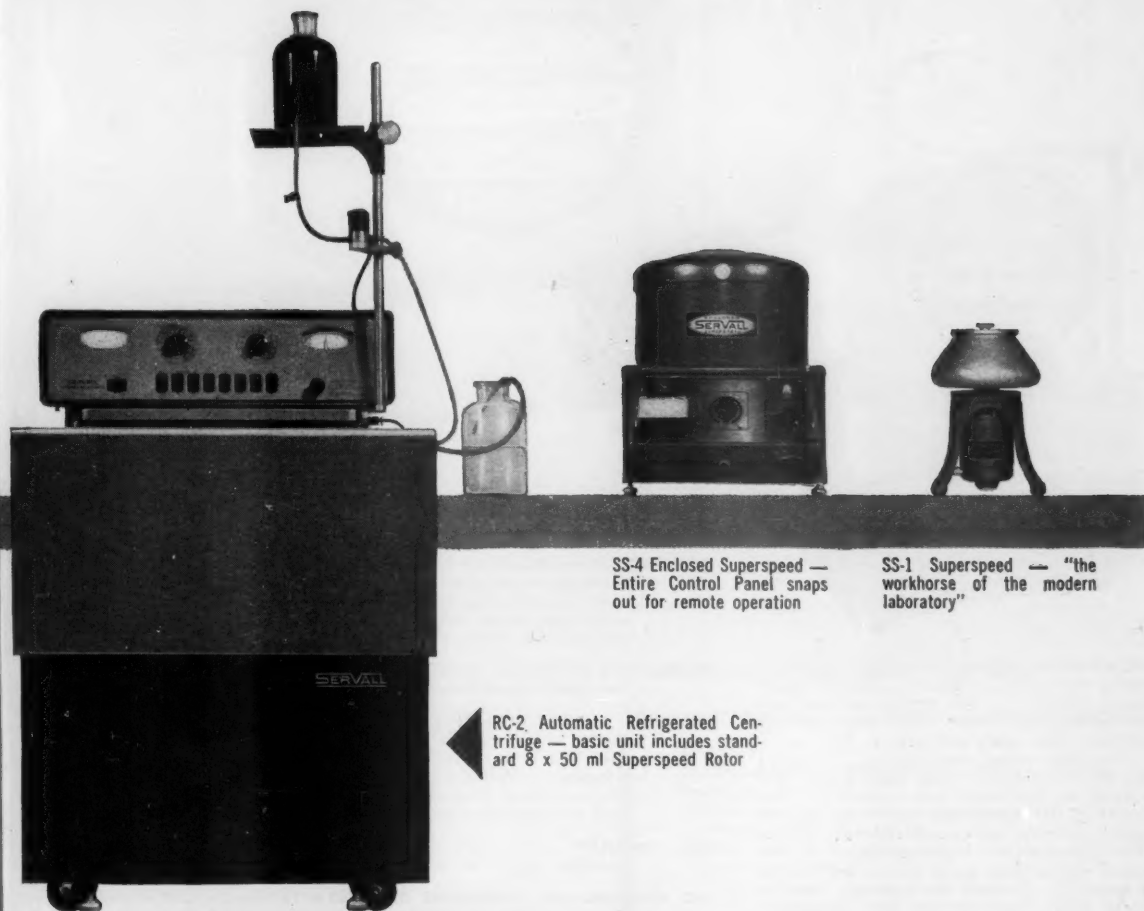
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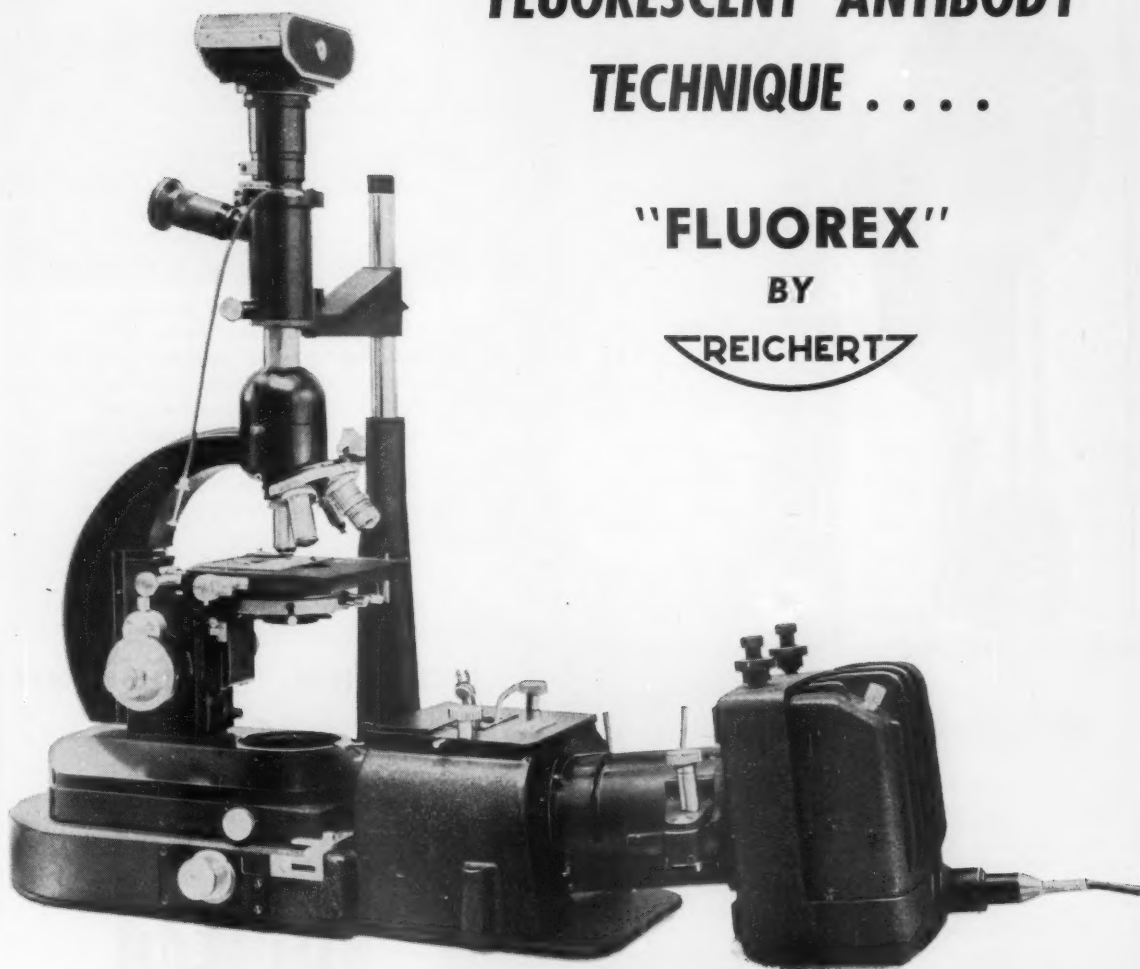


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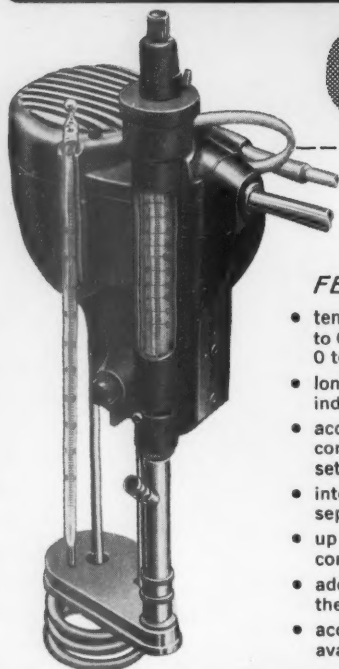
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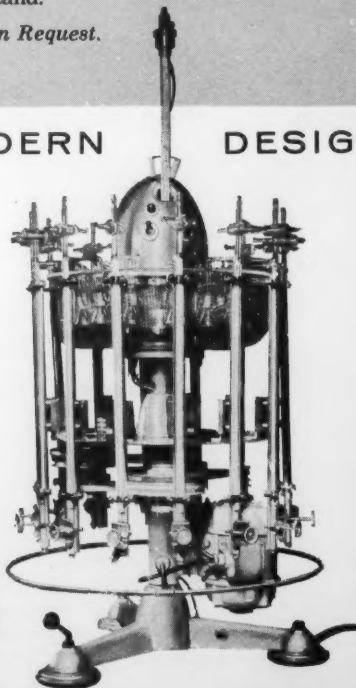
- Designed for compactness—operates on any laboratory bench.
- Magnetic thermoregulator adjustment—temperatures 0 to 50°C present in minutes.
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Concentric-mounted fan to dissipate heat from the lamps is positioned so that the blades do not pass through light beam between lamp and flask. Special cowling shields the observer from direct light, facilitates reading the manometers.

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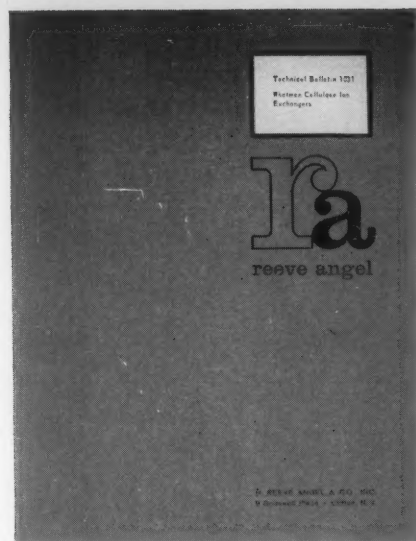
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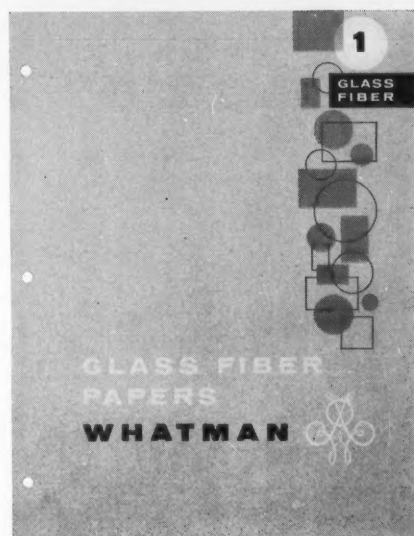
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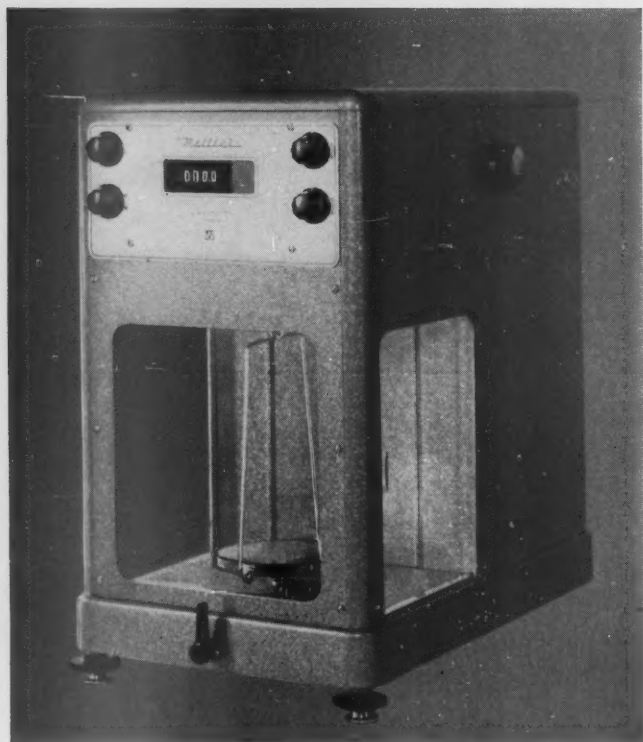
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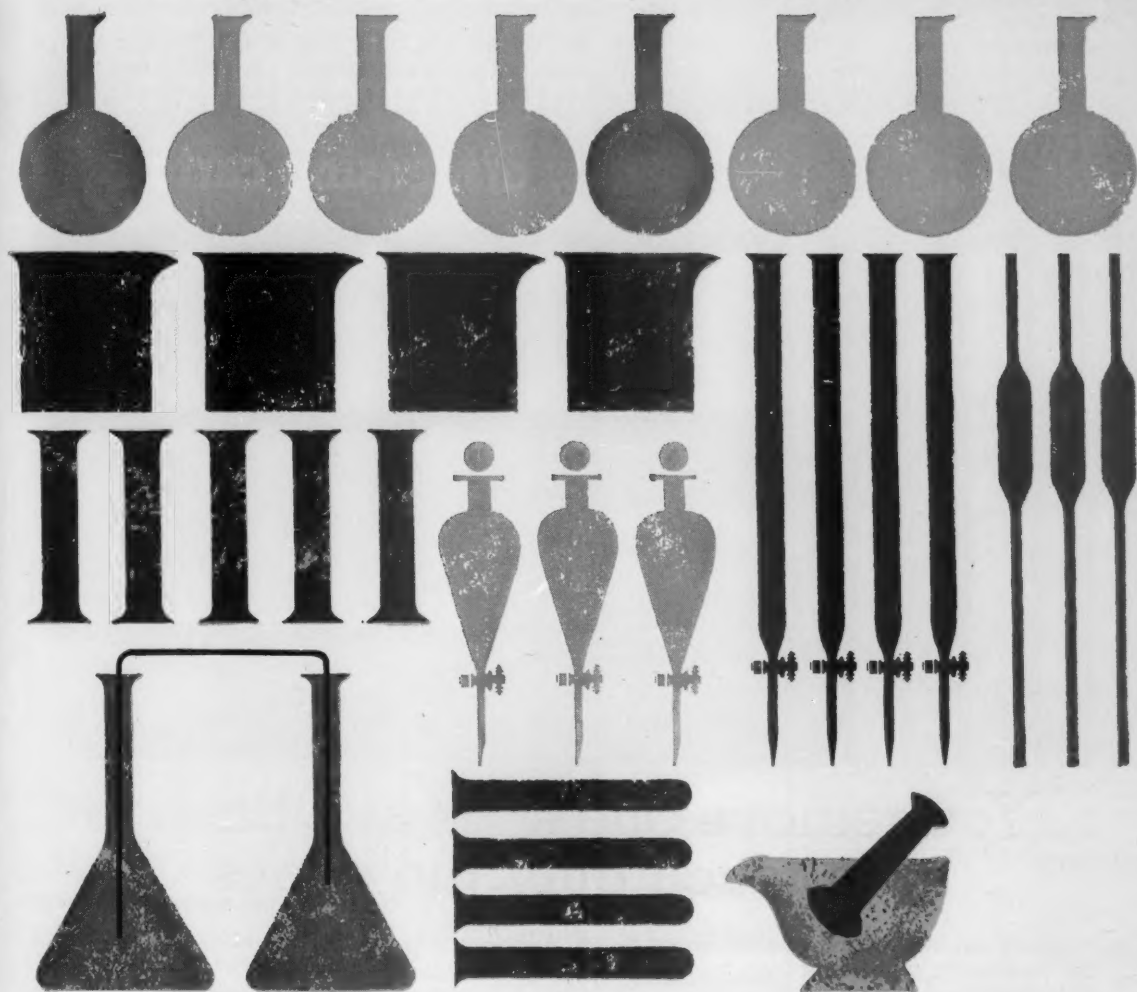
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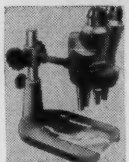
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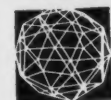
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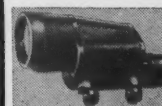
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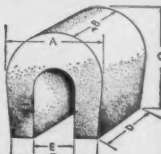
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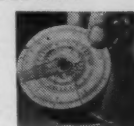
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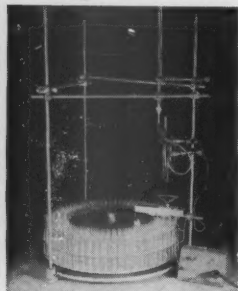
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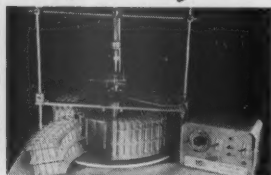
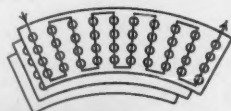
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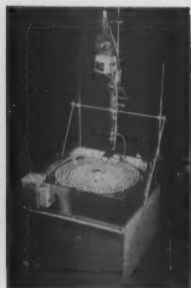
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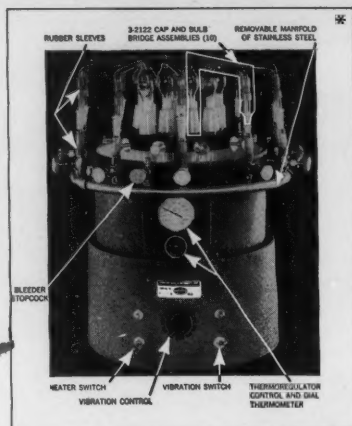
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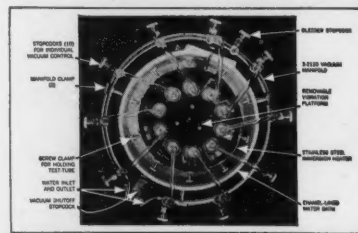
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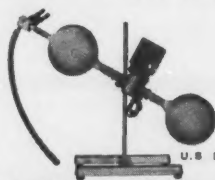
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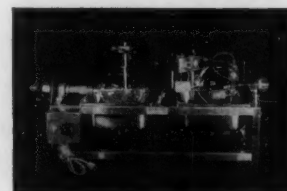
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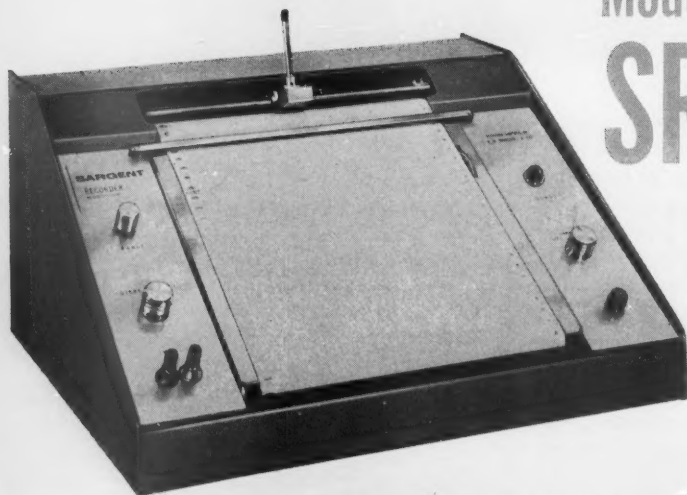
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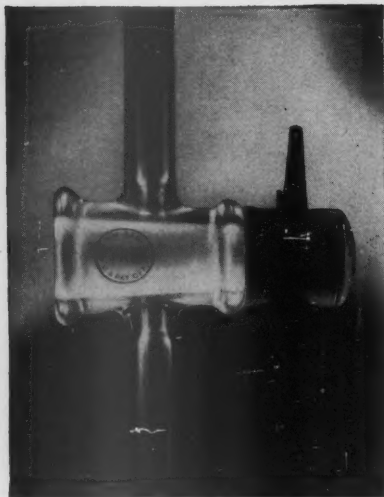
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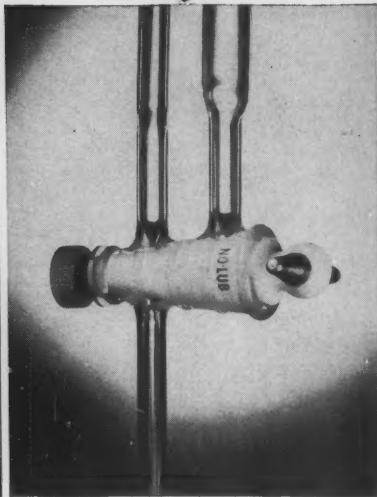


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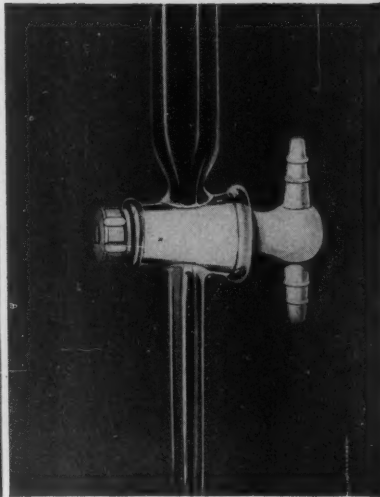
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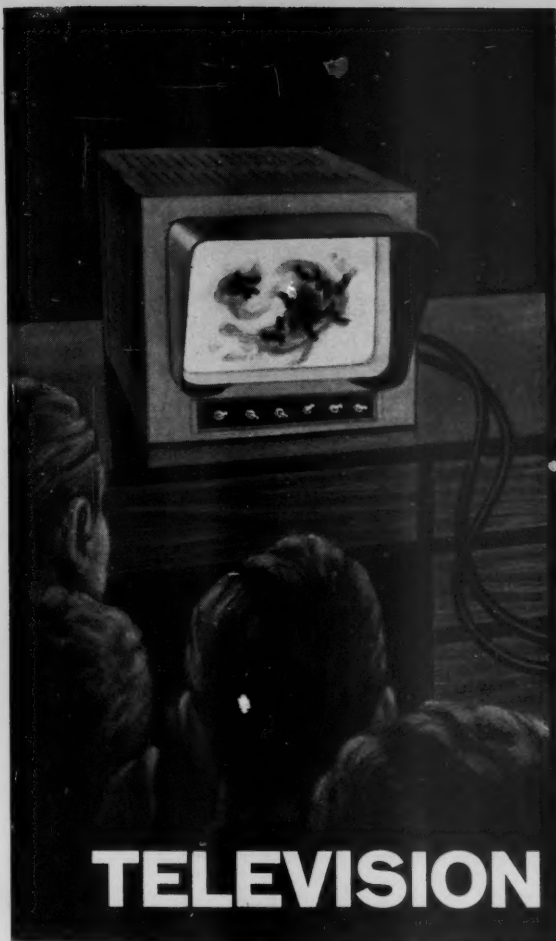
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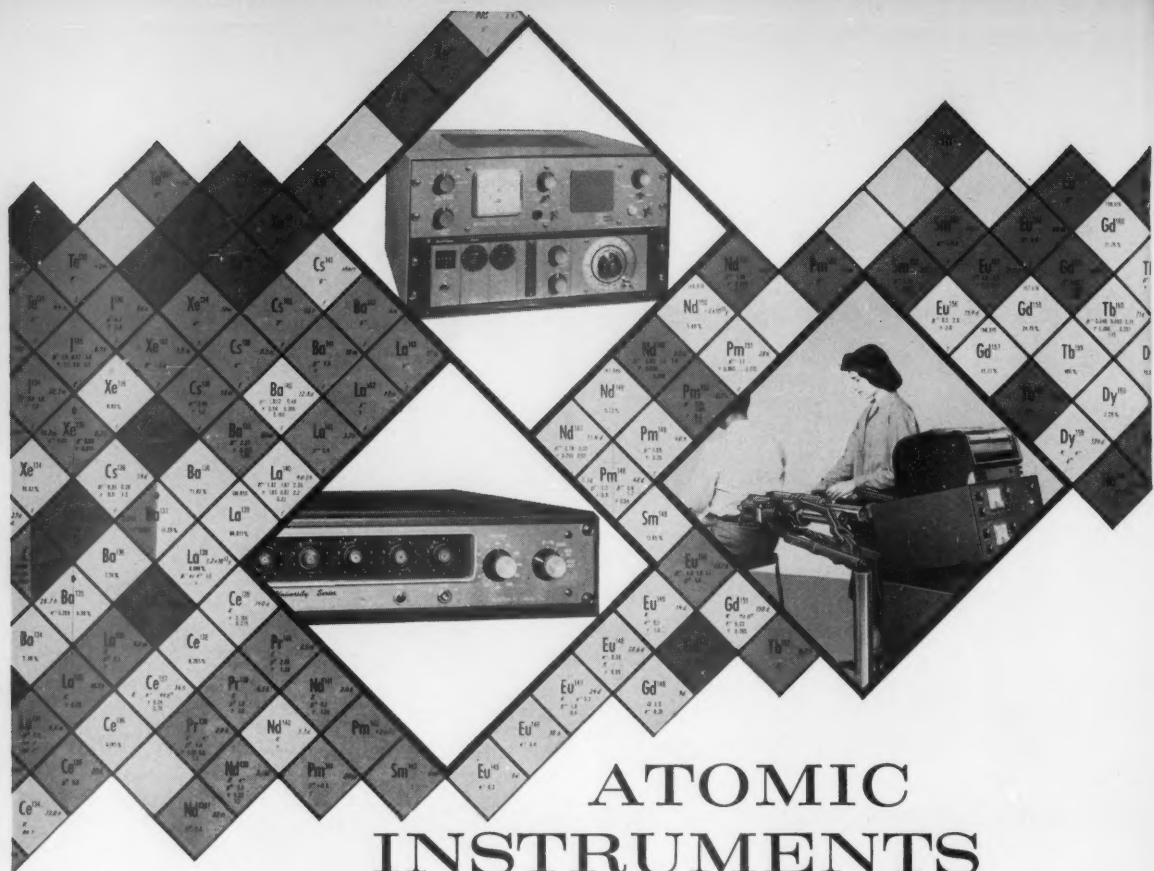
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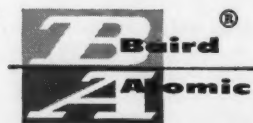
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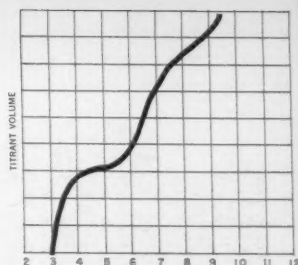
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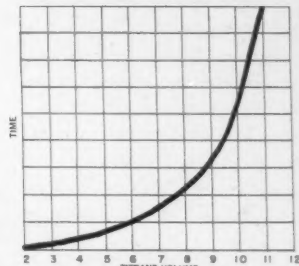
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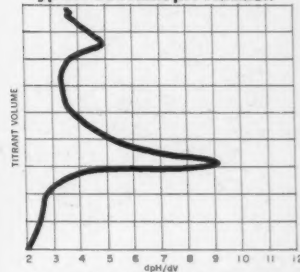
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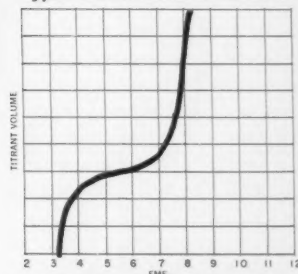
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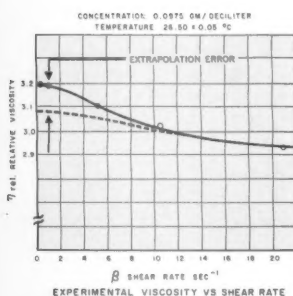
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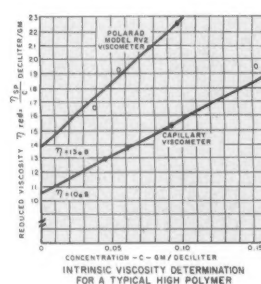
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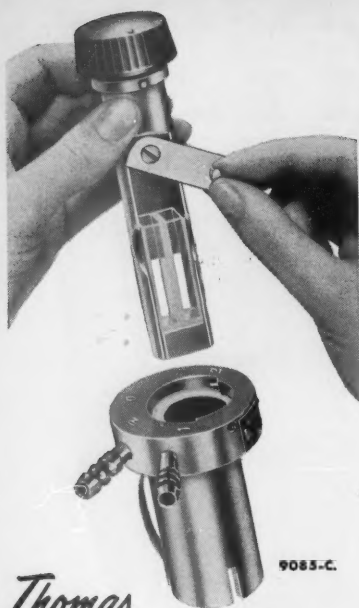
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Letters

Computers in Medicine

As a medical statistician, I read with much interest Robert S. Ledley's article on "Digital electronic computers in biomedical science" [*Science* 130, 1225 (1959)]. I was happy to see how much attention is being given to some of the more mathematically complex problems in medicine today. I find some of Ledley's visions, however, not very realistic, in view of my own experiences. To cover these completely would require an article far more extensive than Ledley's, so I shall confine myself to a sketch of a few points.

Ledley states that there are a great many applications of computers in the straightforward statistical analysis of medical records. A large computer manufacturer investigated this problem, at the request of an organization I was with at the time, and found that the use of computers was too expensive. Standard punch-card machines are better.

With regard to statistical analysis of medical problems generally, I learned through eye-opening experience that large amounts of data and complex mathematical manipulations usually contribute nothing but disappointment and wasted effort. No more valid information can be gotten from a set of data than is inherent in the data. I think most people have to learn this the hard way.

Ledley states that measurements concerning an individual's normal state of health may serve as tools for instituting preventive measures before diseases occur. Vaccination and immunization programs come under this heading, but where do we go from here? It is almost a certainty that we will develop some circulatory-system "disease" before we die, if we live long enough, but how do we prevent it? We know very little about the prevention of many diseases, particularly those which afflict us later in life. Computers, to a certain extent, can help us study these problems, but that is all.

When a machine performs a discriminating function—the problem of diagnosis—it must have good data as well as a good discrimination program. What do we know about "normal values in medicine," fundamental data in this problem? I suggest that Ledley obtain a copy of a fairly recent book by F. W. Sunderman and F. Boerner, *Normal Values in Clinical Medicine* (W. B. Saunders, Philadelphia, 1950), and study some of these values. He should not be content with accepting the stated findings but should look up the original literature references, and should try to compare a set of "normal values" from

one study with those of another study of the same thing. I have done some of this in connection with a book on medical statistics that I am now writing. I was so disturbed by what I found that I am attempting to interest the National Institutes of Health in giving the problem some serious study. In my opinion, adequate data as well as criteria for normality are lacking for many things in medicine.

Establishing normal "base lines" is only one step in dealing with medical problems. Current medical practices require continuous sources of accurate and precise measurements. How accurate and precise are current medical measurements? From the studies I have seen, they are subject to considerable improvement. Look, for example, at unit 3 of *A Syllabus of Laboratory Examinations in Clinical Diagnosis*, by T. H. Ham (Harvard Univ. Press, Cambridge, 1956). Results of a survey of the accuracy of some clinical laboratories are presented. The findings leave a great deal to be desired. Other more recent surveys show much the same thing. The main point here is that we have a long way to go before we can be satisfied with current practices in making some very basic medical measurements. Should we program a computer with data of unknown accuracy?

I would like somehow to convey to Ledley that medicine is *not* a mechanistic science. I know of no better way to learn this than by some first-hand experience. Ledley should visit a local hospital and listen while the physicians discuss their problems. If possible, he should talk to a few patients himself. This should be done in a small hospital in a small town.

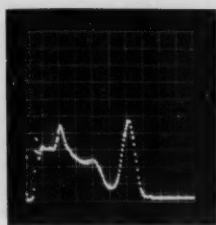
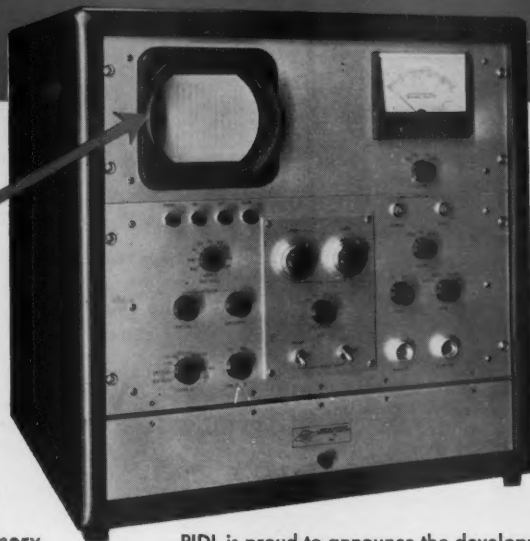
I would like Ledley's opinion as to what to do in a case like this. An aged, senile member of a family is cared for in a nursing home. The financial drain on the family is very heavy, but he requires constant nursing care, too expensive to provide at home. His senility has advanced to the stage where he no longer even recognizes members of his own family. The patient develops pneumonia, which if not treated heroically will probably prove fatal. Should he be "cured" to return to his vegetable existence for a little while longer? Is "old age" a disease?

One prominent medical educator wrote not long ago, "In my opinion, what doctors say and do not say and what they do and do not do is one of today's most important factors in the cause and aggravation of illness" [W. Darley, "What is the next step in improving the teaching of preventive medicine," *Assoc. Teachers of Preventive Med. Newsletter* 6, No. 2 (1959)]. A major factor in medicine is the inter-

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personal relationship between the physician and the patient. What can computers do here?

Finally, I would like to repeat that I am much interested in learning about what is being done with computers in medicine. I think that Ledley's contribution will be greater, however, if he will learn more about the day-to-day problems and practices of medicine.

ROBERT G. HOFFMANN

J. Hillis Miller Health Center,
University of Florida, Gainesville

Of the four general areas of applications of computers in biology and medicine discussed in my article—namely, (i) solutions to equations, (ii) simulations, (iii) data processing, and (iv) information retrieval—Hoffmann is evidently concerned only with aspects of the latter two. He seems to take issue, "in view of [his] own experiences," with my statement that "there are a great many applications of computers in the straightforward statistical analysis of medical records, experimental results, and other data." However, judging from Hoffmann's letter, apparently his own experiences with computers must be quite limited.

Before considering his specific points, I would like to note that he need not worry about a lack on my part of direct personal experience with patients for, although presently not in practice, I have spent several years working in clinics and with private patients. Hoffmann should heed the statement made in the article that presently most applications of computers in biomedical science are being made by people with extensive cross-discipline backgrounds.

I believe that Hoffmann has missed the most important point in his comparison of punched-card machines and computers. As was pointed out in my article, "the advantage in the use of computers ... is not derived merely from the fact that the computer can perform complex mathematical and logical operations rapidly, but rather from the observation that the electronic computer makes feasible the solutions to problems that could not otherwise be approached." Sometimes the use of computers can save money, sometimes not; no categorical statement can be made—it depends entirely on the particular circumstances. But the fact that an electronic computer presents vastly increased capabilities is beyond question. Consider, for example, just the basically simple case of handling ease: The information on a stock of punched cards that reaches as high as the Washington Monument and weighs about two tons would be difficult to manipulate with punched-card machines; under some circumstances a project involving so many cards might be considered unfeasible. But the same

information can be recorded on a 1-foot-high stack of magnetic-tape reels weighing only 30 to 40 pounds, and conveniently processed by electronic computers. Also, it is usually not practical to perform on conventional punched-card equipment any mathematical calculations other than counting or sorting; in many such cases digital computers become a necessity. I certainly agree with Hoffmann that "no more valid information can be gotten from a set of data than is inherent in the data," but obviously no information at all can be obtained from a set of data without processing it. The kind and extent of processing evidently depends on each particular situation.

Hoffmann disagrees with my opinion that the biochemical and physiological indices of an individual's normal state of health can be used as a tool for instituting preventive measures before diseases occur—because, he says, "we know very little about the prevention of many diseases. . . ." The meaning of the words *very little* is of course relative, but it is certain that present knowledge of preventive measures for various diseases is far from zero. When an individual survives a heart attack, his physician frequently suggests many changes in his daily habits to prevent another attack. If these changes in his daily habits had been instituted *before* the first attack, the attack might have been avoided, leading to greater longevity for that individual. [See, for example, M. M. Gertler, M. A. Woodbury, L. G. Gottsch, P. D. White, H. A. Rusk, "The candidate for coronary heart diseases," *J. Am. Med. Assoc.* 170, 194 (1959)].

Hoffmann appears distraught over the facts that "normal values in medicine" do not seem to be accurately known, and that "current medical measurements" are not always accurate or precise. Because of these inaccuracies he concludes that computers cannot be used. Certainly there are areas in medicine requiring vast improvements, but, quite contrary to Hoffmann's opinion, this indicates to me areas where computers can be significantly utilized—as aids to the more systematic collection of data, the more detailed analysis and evaluation of the results, the planning of improved studies, and so on. For example, perhaps the "normal values in medicine" appear not to be accurately known because without the aid of a computer individual variability has not been adequately considered or because it may have been too difficult to consider a sufficient number of factors or data.

In asking my opinion of euthanasia, which is quite irrelevant to the article, Hoffmann probably means to pose a question about computer aids to medi-

(Continued on page 564)



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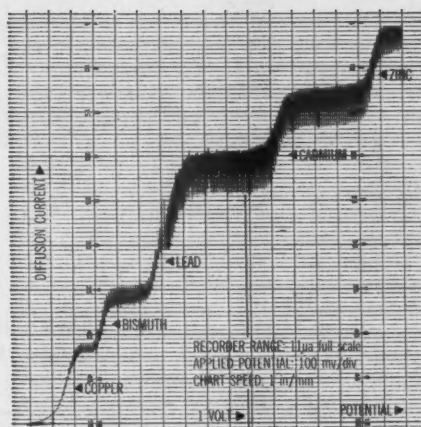
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Footlights and Foot-Pounds

In magnitude of preparations, complexity of operations, number of persons involved, and climactic quality, any large scientific meeting ranks high among other, comparable human activities. The uniquely complex Christmas meeting of the Association, which its own pressroom once described as the "world series of science," might be compared with the staging of a large-scale theatrical production.

The story line is born, and eventually there is a "book"; headliners and others are considered for leads and bit parts, then signed up for the cast; the physical facilities are booked; the playbills go out, and tickets (registrations) are sold, both in advance and at the door; finally, projection equipment and props are mobilized. At last, the "first night" arrives—the house lights dim, the footlights go on, and the audience hushes; in that moment of keen expectancy, everything must go right!

But AAAS meetings have no second nights. Another, not insignificant, difference is that there are scores of "first nights" (the programs) crowded into five and one-half days. And a perhaps poignant difference is that those who produced the programs and organized the meeting will write their own critiques!

An increasing number of those who attend AAAS meetings, however, are impelled to comment, generally in complimentary terms. From such unsolicited observations it is indicated that these registrants have come to realize that the preparations for the Association's annual meeting—and the actual operations connected with it—do add up to a substantial outpour of energy on the part of many people.

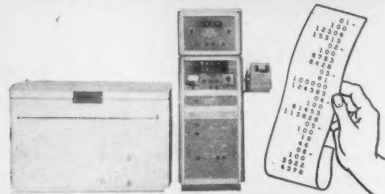
Even those who comment may not appreciate, however, the amount of thought, planning, correspondence, and persuasion that more than a hundred section and society secretaries and program chairmen have contributed. Editing, composing, and printing the General Program requires the almost undivided attention of one AAAS office and one devoted printer during two fall months. Shortly before the meeting opens, the committees on physical arrangements (which install lanterns and provide volunteers to operate them) and local public information become very active.

In the days and hours immediately before the meeting, the Association's office and the pressroom are activated; exhibit booths are erected; large crates and innumerable small cartons are delivered and unpacked, and their contents displayed; the session rooms are cleaned, and chairs arranged. During the meeting, more than a thousand authors deliver their papers, short or long; boards, committees, and councils meet; the registrants commingle and commune, often late into the night. Whether this collectively great expenditure of energy be measured in dynes, ergs, joules, or foot-pounds—and here, Section M's valuable programs on systems of units could help—the sum total, if it could be computed, would be impressive.

The expenditure of all these foot-pounds for the Chicago meeting was well worth while. As the reports in this issue indicate, the 126th AAAS meeting was notable for the uniformly high quality of its programs and exhibits, for the general smoothness of its operations, and for its good fellowship. Those who made the programs possible and those who participated have earned the thanks of the Association. They also have the satisfaction of knowing that, quite literally, they have helped science to advance.—RAYMOND L. TAYLOR, AAAS

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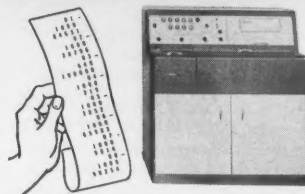


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On the Origin of Life

The possibility of recurring biogenesis and the abiotic origin of optical activity are considered.

John Keosian

The theory of evolution holds that all living things are interrelated by common descent from an original case of successful biopoesis (1). A plausible explanation of how biopoesis may have taken place has been developed over the past two or three decades. Somewhat modified, this explanation can be marshaled in support of the hypothesis that neobiogenesis (1) has been a continuing possibility since life first originated. The rejection of this possibility on the grounds that the conditions which established life no longer exist is not entirely justified.

Origin of Organic Compounds

The most productive hypothesis regarding such conditions is that of Oparin (2). The gradual origin of hydrocarbons and other organic substances, including amino acids, from a reducing atmosphere of H_2 , NH_3 , CH_4 , H_2S , and water vapor is convincingly detailed, and the subsequent formation of polypeptides and polynucleotides of high molecular weight, colloidal systems, and biochemical pathways ("harmonious correlation of separate chemical processes") leading, eventually, to formation

of the first living organisms is logically developed in *The Origin of Life*. Theoretical and experimental support for this hypothesis is already accumulating through the work of Urey (3), Miller (4), Fox (5), Abelson (6), and others. The operation of this hypothesis requires atmospheric conditions, levels of radiation, and ocean temperature, sterility, and salinity which no longer obtain. The origin of life under such conditions involving the whole spectrum of the evolution of life, starting from inorganic substances, probably could have occurred in only one stage of the earth's history. Repetitive neobiogenesis, nonetheless, was possible, and still is possible, from the organic milieu, enriched in amount and variety by living things.

Oparin's hypothesis calls for the gradual evolution of simple, then complex, organic substances at a propitious time in the history of the earth, until the waters attained an appreciable concentration of a great variety of organic compounds, interacting systems, and coacervates. Life was then supposed to originate from this organic "soup" (7). This reasoning holds as well for the continual origin of equally primitive, though not necessarily identical, simple organisms ever since, out of the abundant variety of organic substances ever present since the beginning of life.

Arguments against Recurring Biogenesis

The time factor. Several arguments are leveled against this view. The time factor is one. It will be conceded that from an inorganic atmosphere the origin of organic substances of sufficient complexity and concentration to support the establishment of the first living things might have required special conditions and have taken many millions of years. The sterility which existed before the origin of organisms put no premium on time. After the appearance of organisms, it is unlikely that most organic substances maintained their integrity for more than short periods of time. But in the presence of a complex organic milieu, on the other hand, the time required for the transition from highly complex lifeless systems to metabolizing replicating systems (of the nature of primitive living things) is greatly reduced. Given the proper combination of substances and circumstances, neobiogenesis actually may take only a relatively short time.

A complexity of organic compounds and reacting systems exists today almost everywhere. For example, a cell undergoing cytolysis releases into its environment (which may already be rich in organic substances) globules of colloidal material, microsomes, compounds in different stages of reaction with one another, compounds undergoing sequential reactions still in progress, and so on. It is conceivable that out of such surroundings and under specific conditions, a metabolizing system can arise which has the attributes of life. This is not meant to imply that the components released by a disintegrating cell may be regrouped to form another kind of cell. Rather, this is meant to point to the possibility of the existence locally, at times, of circumstances capable of supporting neobiogenesis in a manner similar to that proposed for the first instance from the original mixture of organic substances. Nor is it implied that neobiogenesis, as

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outlined here, was or is a phenomenon of frequent occurrence; rather, it is proposed that there is a distinct possibility that this event has occurred throughout biological time and may still occur today. The frequency of such an occurrence is a matter which at present cannot be readily determined.

Competition against existing organisms. Another line of reasoning against the occurrence of repetitive neobiogenesis concedes, for the sake of argument, that it is a possibility but proceeds to claim that it would be impossible for a primitive living thing thus evolved to survive in the face of fierce competition from the organisms already present and adjusted to the environment. The assumption that an organism, simply because it is newly arisen, will have no adaptive features and will meet insuperable competition in any place and at any time is unwarranted and untenable. The argument has validity only if it can be established that all organisms of neobiogenetic origin would meet with overpowering competition. This reasoning is based on an exaggeration of the concept of the struggle for existence and ignores interspecific compatibility and aid. As long as it is conceivable that a newly arisen organism may be compatible or symbiotic with the existing organisms in its environment, the argument is invalid. In addition, it is possible that through neobiogenesis subsequent to that of the period when living forms first evolved, parasitic organisms may be established—a situation not possible in the first instance. The original organisms had to have a metabolism independent of the existence of other organisms. Since then it has been possible for organisms which lack various functions (for example, forms without the complete metabolism necessary for independent existence) to arise and lead a parasitic or symbiotic existence. If a unit possessing an incomplete metabolism should arise out of the variety of organic compounds existing today, it would be destined to be destroyed in any local environment devoid of living things. In the presence of cells or organisms possessing the requisite complementary metabolism, such a neobiogenetically evolved form would have a chance of survival. Indeed, for such forms, the presence of other organisms, instead of posing the threat of certain extinction through fierce competition, becomes the *sine qua non* of their origin and

survival. Thus, a wider variety of simple organisms can originate through neobiogenesis today than was the case when living forms first evolved; the first organisms, perforce, had to be of more specific and limited metabolic scope.

Biochemical similarities among all organisms. Another line of argument against repetitive neobiogenesis points to the similarity in the chemistry of all organisms. This subject has many aspects. For example, all naturally occurring amino acids, regardless of source, are of the L form, with notably few exceptions. It is argued that since D and L forms are mutually antagonistic or require different enzymes, the first organisms could incorporate one or the other, but not both, into their metabolism. The evidence is interpreted as showing that chance favored the L form (8). Repeated neobiogenesis, it is argued, would establish organisms which by chance incorporated the D form, and the notable absence of this form is taken to mean a lack of successful instances of neobiogenesis since the period when living organisms first evolved.

Another aspect of this argument is based on the identity of or great similarity between organic compounds found in widely different forms. The same amino acids are found to compose the different proteins in widely different species. Similar metalloporphyrins are the active components of chlorocruorins, chlorophylls, hemoglobins, cytochromes, peroxidases, and catalases, although these compounds may have different biochemical roles. A wealth of other examples exists. Still another argument along the same lines is based on the presence of identical or very similar biochemical pathways in widely different organisms. For example, the ornithine-citrulline-arginine pathway, the tricarboxylic acid cycle, the mechanism for the transfer of electrons in the oxidation-reduction system, and the activity of nucleic acids and "high-energy" triphosphates are found in unicellular and multicellular organisms, plant and animal.

The foregoing observations are taken to mean that the original instance of biopoesis occurred through chance incorporation of specific stereoisomers and specific types of organic compounds. All subsequent organisms, it is claimed, arose by descent from the original form and thus were compelled to utilize the same compounds. Muta-

tion, based on the existing substances, established an increasing variation in compounds, pathways, and species, which were all interrelated, however, through common descent. Organisms descending from separate forms of neobiogenetic origin, it is argued, would be expected to show greater variation, some of these forms having been established, by chance, with opposite antipodes, different organic compounds, and different pathways.

All these observations overlook the probability that, some time after the first organisms arose, the preponderance of biochemically important, optically active, organic substances changed from racemic mixtures to the isomers characteristic of the first successfully established organisms. Whereas the synthesis of organic substances in the absence of living things would usually lead to the formation in equal quantities of both forms of enantiomorphous substances, enzymatic synthesis results in the formation of only one of the antipodes. As the formation of organic compounds shifted from abiotic synthesis to synthesis by living things, there occurred a change in over-all synthesis from racemic mixtures to, preponderantly, the biologically selected isomers. Gradual degradation of the biologically rejected antipodes and their conversion into the biologically accepted ones would result in the shift of emphasis mentioned. Subsequent instances of neobiogenesis would have to occur within such a milieu, and consequently the forms would possess a chemical similarity to pre-existing organisms. Too, subsequent forms of neobiogenetic origin, having as a basis not only existing organic molecules but also existing reacting systems—that is biochemical pathways—would exhibit common metabolic aspects. Such organisms would consequently contain many compounds, develop biochemical pathways, and exhibit reactions characteristic of pre-existing organisms.

Origin of Optical Activity

Intramolecular displacements and conversion of racemates are not the property of living things or enzyme systems only. This problem has been investigated by Winstein, Streitweiser, and others (9). In the last few years evidence has also been adduced for stereospecific polymerization in the presence of complex catalysts (10-17). Ziegler (10) re-

ported the formation of polymers of high molecular weight with complex catalysts under normal conditions of temperature and pressure. These catalysts consisted of a mixture of TiCl_4 and triethyl aluminum in heptane. The polymerization of ethylene under these conditions takes place rapidly and is devoid of short-chain branching. Natta and his school expanded these observations with intensive investigation (12-17) of modifications of the Ziegler catalysts. They experimented with combinations of TiCl_4 and of TiCl_3 with aluminum trialkyls (AlR_3) where R equals CH_3 up to C_6H_{13} . Stereospecific polymerization occurred and was highest with the violet crystalline form of TiCl_3 and triethyl aluminum, the longer-chain alkyls being less effective (14). Other factors which affect stereospecific polymerization are discussed by Natta in a later paper (16). Some of these polymers, on crystallographic analysis, appear to have a helical structure and are formed by terminal addition of monomers (12); this brings to mind the end-chain addition of mononucleotides to deoxyribonucleic acid primer (18) and to ribonucleic acid (19). The structure of the catalyst complexes was also studied (15). It was found that the active catalytic centers are metallo-organic complexes which exist in enantiomorphous pairs, each member controlling the synthesis of the corresponding antipodal polymer. The result is a mixture of optically active antipodes. This resembles stereospecific synthesis in living forms where each stereoisomer has its corresponding enzyme and differs from the usual abiotic synthesis of stereoisomers, in which both antipodes result in equal numbers from the same catalyst. In the latter case a single mechanism operates, and chance determines the alignment of an asymmetric center in any of its possible positions. It is not possible to separate such a process into different specific stereoisomeric syntheses. In the former case this is conceivable, and as Natta points out, it would be of "remarkable interest" to isolate the asymmetric active centers corresponding to only one of the two enantiomorphous forms, "since it could solve the problem of asymmetric organic synthesis in the field of macromolecules" (15). Many important developments can be expected from this new research field. These considerations raise the question whether some resolution of racemic mixtures could al-

ready have taken place or optical activity could have already occurred before the emergence of life, the occurrence of specific antipodes in the first organisms thus being not merely left to chance.

Past Controversy

A brief historical survey may be pertinent at this point. Experimental evidence at various times has been brought in support of, and against, the possibility of spontaneous generation. Aristotle's (20) belief in spontaneous generation dominated scientific thinking for many centuries. Outstanding among his followers was Needham (21) who, two thousand years later, defended spontaneous generation, whereas his contemporary Spallanzani (22) held the opposite view. The controversy was once again revived one hundred years after that by Pouchet (23), who supported the possibility of spontaneous generation, and Pasteur (24), who apparently closed the issue by disproving the contention of his antagonists with his brilliant experimentation. Aside from the fact that, in general, a negative result in an experiment merely tells of the failure of that experiment but does not necessarily preclude success in further experimentation, all experiments testing neobiogenesis have been of too limited a scope to be valid. Contrary to popular belief, Pasteur did not disprove spontaneous generation, as an examination of his reports will show, but rather, he demonstrated the faultiness in design of the experiments of his predecessors who claimed to have shown the occurrence of spontaneous generation. His papers bear titles such as "Experiments relative to generation said to be spontaneous." His central interest was in showing that fermentable mixtures would not ferment if they were not brought into contact with the "germs" present in the air but would do so on exposure to such particles. He successfully demolished the contention of those who claimed to have demonstrated spontaneous generation but did not disprove "once and for all" the possibility that the most primitive microorganisms originated through neobiogenesis. In more recent years, with the technological, biochemical, and philosophical advances that have been made allowing deeper penetration into the problem, the ever-recurring question once again

may be raised, but at a more sophisticated level.

Proposed Modification of the Monophyletic Theory of Evolution

Repetitive neobiogenesis, as suggested above, would establish organisms similar in metabolism to known forms. The suggestion that repetitive neobiogenesis may be expected to establish exotic forms of life different from the form of life as we know it may have a place only in science fiction. It may very well be that life as we know it—that is, the complex, interdependent metabolic reactions supported in a structure we recognize as protoplasm—is the only form that matter can eventually take in its evolution toward the origin of organisms. Indeed, it is possible, even though it appears improbable, that life can exist only with the specific isomers which we find associated with it, and that the presence of these isomers was not the result of random choice but of necessity.

One may well ask what is gained by proposing the repetitive origin, in time, of organisms based on a structure and metabolism similar to pre-existing organisms. The answer, of course, is that it does not matter how similar the results of neobiogenesis are to pre-existing organisms. But the idea that neobiogenesis is possible, and may have been taking place ever since life first occurred, does matter. Concretely, it would appear more plausible to accept present-day viruses as units of recent and present origin than to suppose that they descended through some two billion or more years relatively unchanged. Throughout time, viruses either evolved into higher organisms or were eliminated in the process of evolution, being ever re-established through neobiogenesis. The same may be said for bacteria at any period in time, except that bacteria probably represent some degree of evolution from a more primitive progenitor. They, too, are destined for further evolution or elimination, while progenitors, already arisen, continuously evolve into the newer bacteria.

The discontinuities in the paleontological evidence are explained away by the contention that some forms are not subject to fossilization, while many that are did not encounter the conditions favorable for fossilization, and, finally, the conclusion that many discoveries have yet to be made. Some of the

discontinuities, however, can be viewed as the result of separate cases of neobiogenesis. The same may be said of the discontinuities in the taxonomic arrangement of existing organisms. The difficulty of placing viruses, bacteria, certain "algae," sponges, and so on, in a fitting place in any taxonomic scheme based on a monophyletic hypothesis may stem from the possibility that the discontinuities are real and represent the existence of separate lines of descent from independent instances of neobiogenesis at different times in the history of the earth down to the present (25).

References and Notes

1. *Biopoesis* is used here in the same sense as at the 1957 Moscow conference on the origin of life, to refer to the whole process of the evolution of life from inorganic beginnings, whereas *neobiogenesis* is used to refer to the establishment of primitive organisms *de novo* from a complex organic environment already present from any source. The term '*spontaneous generation*' is associated with theories proposing the spontaneous origin of higher organisms—flies, frogs, rats, and so on—as well as microorganisms from lifeless matter. Its use is avoided in this discussion, except in a historical sense.
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7. Recently J. D. Bernal (preprints, International Oceanographic Congress, 1959) restated his hypothesis that small organic molecules—amino acids, purines, pyrimidines, and so on—appearing in the waters were concentrated by adsorption on estuarine and terrestrial clays and there polymerized into molecules of greater molecular weight. The latter were then released and, along with other complex organic compounds in the environment, interacted to form a protoplankton. Under such conditions life could originate, eventually, without requiring the presence of an organic "soup" throughout the hydrosphere. Abelson (International Oceanographic Congress, 1959) called attention to the random interaction of organic compounds in aqueous solution in vitro to form an unusable tarlike mass. Moreover, the presence of adsorbents would, he maintained, prevent the waters from attaining anything like the concentration of a "soup."
8. G. Wald, in his article "The origin of optical activity" [*Ann. N.Y. Acad. Sci.* **69**, 352 (1957)], proposes the view that the first organisms incorporated both enantiomorphous forms of optically active substances, but that the operation of the principle of natural selection on a molecular level established in living things the present isomers which "won the fight" over their antipodes.
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24. L. Pasteur, *Compt. rend.* **50**, 303, 674, 849 (1860); *ibid.* **51**, 348 (1860); *ibid.* **56**, 734 (1863); *Ann. chim. et phys.* **3**, 64 (1862).
25. The views expressed in this article have been the result of much pondering over a long period. They could hardly have come to fruition in my mind without the many stimulating discussions on a wide variety of subjects in which I was privileged to participate. Outstanding among these were the lectures and seminars which are the fare every summer at the Marine Biological Laboratory, Woods Hole, Mass., and the many conversations with friends with whom I could confidently discuss these somewhat unorthodox ideas. I wish to mention especially my colleagues B. P. Sonnenblick and G. Panson, my research assistant Paula Gottdenker, and Lionel Luttinger of the American Cyanamid Co. Their friendly but penetrating criticism taxed me again and again and helped me to a better expression of my thoughts. I cannot speak for the extent to which I have convinced those who have heard me, and I must take the responsibility for the ideas expressed in this article.

Somatic Radiation Dose for the General Population

The report of the Ad Hoc Committee of the National Committee on Radiation Protection and Measurements, 6 May 1959

At its meeting in November 1958, the executive committee of the National Committee on Radiation Protection and Measurements undertook to re-examine the problem of exposure of the population to man-made radiations from the point of view of somatic effects as distinct from genetic effects. This review was undertaken because of the widespread public concern over the possible effect of radiation from fall-

out on the population, and because of the possibility that there might be some new, definitive information regarding the somatic effects of chronic low-level radiation on man.

The NCRP was unaware of any new basic information on somatic effects of radiation, upon which it could with sound reason recommend specific changes in permissible exposures for individuals or for population groups.

The NCRP felt that information relative to the question was essentially the same as that outlined in National Bureau of Standards Handbook 59. However, it appeared desirable to make a new and independent examination of the problem for the purpose of affirming the views of the NCRP. For this purpose, the NCRP established an Ad Hoc Committee to examine the question further.

At its inception, the National Committee on Radiation Protection and Measurements centered its activities primarily around the problem of radiation hazards associated with industrial and medical uses of radiation. During succeeding years, it became increasingly apparent that NCRP could not ignore its responsibility for making recommendations concerning radiation exposure of larger population groups. Cognizance was taken of this problem at various times—for example, in NBS Handbook 59 (issued 24 September 1954), on pages 78 and 79, in the paragraphs "Non-occupational Exposure of Minors" and "Number of Ex-

posed Individuals" as well as in the separate paragraph found at the end of the Handbook. On 8 January 1957, the preliminary statement released by NCRP setting forth its revised philosophy on the maximum permissible radiation exposure to man suggested a certain limit for average gonadal exposure of the population. The addendum to NBS Handbook 59, dated 15 April 1958, contained additional recommendations concerning the maximum permissible dose to individuals outside controlled areas, and attributable to normal operations within controlled areas, for both external radiation exposure and internally deposited radioactive materials. In its statement of 23 April 1959, the use of the same maximum permissible dose (MPD) was extended to individuals in the population-at-large.

The Ad Hoc Committee report, the NCRP believes, serves to reaffirm the broad policies of the NCRP with regard to basic permissible dose criteria, but the report is not to be regarded as containing specific recommendations by the NCRP.

The report takes the line of conservatism. The Ad Hoc Committee felt that there was no other choice until more and better information is available on the effects of low-level chronic radiation exposure. Although a conservative and possibly pessimistic assumption with regard to radiation effects has been made, this should not carry any implication that either the NCRP or the Ad Hoc Committee accepts such assumptions as established facts. These assumptions have been adopted in the interests of prudence.

Upon review of the Ad Hoc Committee's report, it was noted that while the report suggests a basis for expressing the maximum permissible somatic dose for the population, it does not contain specific recommendations immediately applicable as maximum permissible doses. It also appears likely that the maximum permissible doses that might be derived from the Ad Hoc

Committee's report would not be widely different from the current recommendations of the International Commission on Radiological Protection even though they are expressed in reference to another base. This report is, therefore, being referred to NCRP subcommittee I on "Maximum Permissible Dose Criteria" for further consideration and the possible formulation of specific values to be recommended as the maximum permissible dose. Pending the possible formulation and approval of such recommendations, the NCRP recommends the use of the current recommendations of the ICRP concerning permissible doses for the population.

Report of Ad Hoc Committee

I. Introduction

The National Committee on Radiation Protection, in the past, has recommended maximum permissible doses of ionizing radiation for occupationally exposed persons and other special groups. Its recommendations regarding exposure of the whole population to radiation have been primarily concerned with the genetically significant dose. An increasing number of sources of man-made radiation, industrial and military, make it desirable to consider the setting of maximum permissible levels of somatic exposure for the general population. This becomes increasingly important in view of the fact that certain radioelements, such as strontium and iodine, are nonuniformly distributed in the body and result in much larger doses to specific body tissues than to the gonads. This Ad Hoc Committee was appointed to examine the problem and report to the National Committee on Radiation Protection.

The Ad Hoc Committee has considered the basic concepts and premises by which maximum permissible levels of ionizing radiation for the general population might be established and how these might be applied to radiostrontium and other widespread contaminants.

II. Dose-Effect Relationship at Low Doses

Radiation doses to which the general population is likely to be exposed in peacetime are very low. Furthermore, the rate of delivery from most sources is slow, so that a small dose is accumulated over a long period. Yet the existing data upon which present protection

criteria are based are from experimental animals exposed at higher, and frequently from acute, doses. Similarly, human data that are available are also primarily from higher doses.

If we understood the exact mechanism of the interaction of radiation and biological tissue, and the subsequent chemical, physiological, and morphological events leading to the final effects, we could extrapolate back to very low doses and make confident estimates of the extent of human damage to be expected from such a dose. Lacking this information, we must rely on the character of the dose-effect curve at higher doses and estimate the effects of changes in intensity and spacing of the dose.

A proportional (linear nonthreshold) relation between dose and biological effect is usually taken to imply a single-event process, especially if this is supported by data showing dose rate independence. More accurately, the relationship is $\log S = -kD$ (where S is the proportion not effected, D is the dose, and k is a constant). At low doses, this is not distinguishable from a straight line. With such a dose-effect relationship, linear interpolation between the observed values and the origin is acceptable when the doses and the related effects are too low to be measured accurately with our present methods.

If the true relationship is curvilinear at low doses, or if there is a threshold dose below which no effect is produced, a more complex mechanism may be inferred and extrapolation to lower doses could be grossly misleading.

The committee concludes that the present data are still insufficient to establish the character of the dose-response curve for somatic effects. Nor is there sufficient knowledge of the mechanisms to serve as a guide in areas where the data are not available.

In the absence of such information, the committee believes that it is prudent to be conservative and choose a premise which, if in error, would be likely to overestimate the effect of low doses rather than underestimate it. The committee decided to adopt as an assumption that a proportional relationship between dose and effect exists, as briefly outlined above. This signifies that no threshold exists, and, by inference from some of the theoretical concepts, we will assume further that the radiation dose is completely cumulative and that the effect is independent of the rate at which the radiation is delivered.

The members of the Ad Hoc Committee of the National Committee on Radiation Protection and Measurements are: Austin Brues, Argonne National Laboratory; James Crow, University of Wisconsin; E. B. Lewis, California Institute of Technology; Karl Z. Morgan, Oak Ridge National Laboratory; W. S. Snyder, Oak Ridge National Laboratory, alternate; Clinton Powell, U.S. Public Health Service; Frederick Seitz, North Atlantic Treaty Organization; Forrest Western, U. S. Atomic Energy Commission; and Hymer L. Friedell, Western Reserve University, chairman. Lauriston S. Taylor, chairman of the National Committee on Radiation Protection and Measurements, prepared the introductory material.

If there is a threshold, there will be no effect at doses below this threshold value. If the true relation is curvilinear with an accelerating effect as the dose increases, such as would occur if the biological effect depended on multiple events or on a mixture of threshold and nonthreshold causes, the proportional assumption overestimates the effect at low doses. There is the possibility that the curve is concave in the opposite direction, but this seems very remote. Moreover, data that show a dose-rate dependence generally indicate that the effect is less with a low rate of delivery or with intermittent dosage than with the same total delivered in a short time. For these reasons, the committee believes that the proportional assumption is a conservative, and perhaps a stringent one.

The Ad Hoc Committee emphasizes that this conservative assumption was adopted not because any definitive conclusions were reached as to the true nature of the dose-effect relationship but because the committee would prefer to err on the side of overcaution rather than in the opposite direction. With this assumption (nonthreshold linear dose-effect relationship), or, for that matter, any nonthreshold assumption, it follows that even the smallest dose would involve some risk. This means that the exposure should be kept as low as feasible and that no level of radiation is warranted unless the benefits balance or outweigh the assumed risk.

This also means that if a maximum permissible dose is determined, it will necessarily be at an arbitrary level where, in the judgment of those choosing the level, the risk is acceptable as compared to the benefits. Every effort should be made to maintain the actual dose as far below the permissible level as possible.

III. Should the Population Dose Differ from that for Occupationally Exposed Groups?

The committee believes that the dosage permitted for the general population should be substantially less than that permitted for occupationally exposed or other special groups. Some of the reasons are:

- 1) The general population is much larger, and if exposed to the same dosage there will be the risk of a correspondingly larger number of individuals with injurious effects.

- 2) Employment involving occupa-

tional hazard to exposure is voluntary, and the extent and nature of the exposure can, in principle, be foreseen by the individual accepting any risk that may be involved.

- 3) Industrial workers are relatively carefully screened. Generally, those least able to meet any peculiar hazard may be channeled into other activities.

- 4) In industry there can be specific evaluation and control of the hazards by radiation monitoring and other studies.

- 5) Children and embryos may be particularly sensitive. These can generally be excluded from groups receiving the maximum permissible occupational dose.

- 6) The number of years of exposure to radiation for occupational reasons will be much less than the number of years of exposure to environmental sources of radiation.

- 7) If industrial hazards exist, it is obvious that any of these hazards (one of which is radiation) should not be spread beyond the individuals in that particular occupation. If the hazards to the outside nonindustrial population are not reduced as compared to those within the industry, the risk to the total population could be unacceptably high because of the contributions from all the occupational hazards in the society.

For these reasons, the committee believes that it is appropriate to set lower maximum permissible doses for general population groups than for persons exposed to radiation for occupational reasons.

IV. Bases for Establishing a Maximum Permissible Dose

On the basis of the assumption discussed in section II, any realistic recommendations of maximum permissible dose must be reached by balancing biological risks against the reasons for accepting exposures to radiation. It is highly improbable that such a balance can be made with accuracy, not only because of our limited knowledge, both of benefits and of risks, but also because of difficulties in comparing social, economic, and other benefits with radiation risks. Nevertheless, since decisions will be made, if only by default, it is desirable to make the best evaluations possible at the present time.

As a first approach, there are several possible scales on which the risks from low levels of radiation dose may be related to human experience. The committee believes that all of these are

meaningful and has tried to consider them in its deliberations.

- 1) *Relating the population dose to the level established for occupationally exposed groups.* This could be done by taking an arbitrary fraction of the occupational dose and using this as the maximum permissible dose for the general population.

- 2) *Relating population dose to the estimated effects of radiation and to other risks of life.* The estimated effects of the exposure of the public to low doses of radiation can be assessed in principle in three ways: (i) by their estimated absolute incidence; (ii) by their estimated incidence relative to the spontaneous incidence of the same biological effects, e.g. leukemia; and (iii) by comparison with the effects of other population risks not associated with radiation.

- 3) *Relating the population dose to the natural background radiation level.* If any risks are associated with natural background radiation, they are accepted as a normal factor of life. Ordinarily no effort is made to reduce them, and ordinarily no consideration is given to differences in background levels in determining where one shall reside.

The committee recommends, pending more precise information, that maximum permissible doses for the general population should be related to the average natural background level of radiation. One reason is that this level can be determined relatively easily and is relatively stable in time. A more important reason is that this is a level to which the human population has been exposed throughout its history. The further we get from this level, the less confidence we have that any effects will be similar in kind and quantity to those the population has experienced from natural background radiation and has been able to tolerate in the past.

V. Recommendations Regarding Permissible Doses to the Population

It is not the responsibility of this Ad Hoc Committee to recommend specific levels of maximum permissible dose to the population. It hopes that as more data become available, both as to benefits and risks, a maximum permissible dose representing a proper balance between these can be found. Meanwhile, it believes that the maximum permissible dose of man-made radiation (excluding medical and dental sources) should not be substantially higher than the background level of natural radiation.

tion without a careful examination of the reasons for higher values. For this purpose it may be convenient to take the background level arbitrarily to be 100 millirem per year.

In the practical application of maximum permissible levels to the general population, it is necessary to consider a number of factors, some of which are noted in the following discussion.

It is not feasible at the present time to monitor the population dose solely by measuring the dose to individuals. Moreover, any control measures to be effective must be directed at levels of radiation and of radioactive materials in the environment. Thus, it is contemplated that maximum permissible levels for such environmental factors as food, water, and air will be set for certain areas in such a manner that the radiation dose to typical persons in those areas from all sources (excluding natural background, medical, and dental sources) will not exceed the appropriate maximum permissible level. For this purpose the committee recommends that it should be allowable to average doses over a suitably long period of time, e.g. one year, and over population groups approximating the size of a state or major city. Because of variability of dose levels with location, it is expected that the average dose to the total population would be considerably less than the maximum permissible level.

Some radioisotopes are distributed through the body in such a fashion as to give an approximately uniform distribution of radiation dose to all of the body tissues. However, from certain radioisotopes, such as those of strontium and iodine, radiation doses are much higher in some tissues than in others. In general, the maximum permissible level should apply to the tissue receiving the greatest dose—bone in the case of strontium, thyroid for iodine. If several sources of radiation are involved, the total dose to the tissue from all such sources should not exceed the maximum permissible level.

It is recognized that for some radioisotopes, environmental levels may conceivably result in higher radiation doses to children than to adults. In such cases, permissible levels should apply to radiation doses received in the age ranges of highest dose, rather than to the population group as a whole.

The committee emphasizes that the final criterion in environmental control is the level of radiation dose to

human tissues, and that environmental levels are used only as indicators and means of control. At the present time permissible levels for the environment may be derived from permissible levels of dose to humans only by making certain assumptions involving such factors as movement of radioisotopes in the environment, relationships between environmental and dietary concentrations, and biochemical behavior in the body. Recommended maximum permissible concentrations in the environment will require revision as new information on such factors becomes available, or as indicated by actual experience with environmental situations.

Since any maximum permissible level based on the considerations discussed above is a relative standard designed to keep the average radiation dose to the population as low as feasible, it follows that *a level recommended for one set of conditions may not be appropriate for another*. For example, maximum permissible concentrations in foods designed to limit the release of radioactive materials into the environment may appropriately be much lower than levels at which the foods may be considered unfit for use; and maximum permissible concentrations in air designed to limit the release of materials into the environment may be much lower than levels at which it would be wise to evacuate an area in case of accidental release of larger quantities of such materials.

VI. Discussion

This committee has not made any recommendations regarding medical and dental radiation. The reason is that in this case the individual exposed to the risk and the one receiving the benefit are the same. The balancing of the risk is largely a medical problem. Furthermore, there are circumstances when going beyond any preassigned maximum permissible level may be thoroughly justified. It is axiomatic that every reasonable precaution should be exercised to keep the radiation dose as low as possible.

The Ad Hoc Committee was not asked for comments regarding genetically significant radiation. With the assumption of an effect proportional to the dose, which is the same as is generally assumed for genetic effects with low doses, some of the genetic and somatic considerations become very similar. Some sources of radiation, such as radioactive cesium, give about the same dose to the gonads as to other

parts of the body. For others, such as radiostrontium, the gonad dose is exceedingly small in comparison with the bone dose.

The committee would like to note that if the National Committee on Radiation Protection chooses a maximum permissible dose of man-made radiation, exclusive of medical and dental sources, in the general vicinity of the background level, there will be an order of agreement with the recommendations of other groups that have studied the problem. The previous recommendation of the National Academy of Sciences Committee and the National Committee on Radiation Protection for a maximum average-per-capita-dose to the gonads of 10 roentgens of man-made radiation per 30 years is roughly three times the background level, and these recommendations include the estimated contribution from medical and dental radiation. We note the maximum permissible dose of whole-body exposure for a single individual recommended for the general population by the International Commission on Radiological Protection and the NCRP, although expressed in terms of a fraction of the permissible occupational exposure, is approximately five times the background. For long-range planning purposes, the International Commission on Radiological Protection has suggested a permissible average level for the whole population in the general vicinity of the background dose (a man-made radiation level of 1.7 times background, if background is taken to be 100 millirem per year).

VII. Summary: Conclusions

On the basis of the general principles outlined previously, and examination of some of the problems posed by widespread man-made contamination by various radioelements, the committee makes the following recommendations for the guidance of those concerned with the establishment of tolerable somatic levels for widespread radiation:

- 1) The committee believes that present evidence is not sufficient to establish the dose-response curve for somatic effects at low doses. In the absence of such information, the committee has chosen to make the cautious *assumption* that there is a proportional relation between dose and effect and that the effect is independent of dose rate or dose fractionation.

- 2) On this, or any other nonthreshold assumption, it follows that even the

smallest dose is associated with some risk. Under these circumstances, the exposure of the population to any increase in radiation should not occur unless there is reason to expect some compensatory benefits.

3) Because of our present limited information, an accurate estimate of the hazard and the benefits of a specific level of radiation is not possible. Therefore, pending more precise information, we *recommend* that the population permissible dose* for man-made radiation be based on the average natural background level.

Although it is not our responsibility to determine the exact level, we believe that the population permissible somatic dose from man-made radiations, excluding medical and dental sources, should not be larger than that due to natural background radiation, without a careful examination of the reasons for, and the expected benefits to society from a larger dose.

It is expected that, because of fluctuations in time and location, the population average dose will be considerably less than the maximum permissible dose.

4) For purposes of computation, it

should be permitted to average the amounts over a suitably long period of time, e.g. one year, and a reasonable sized population.

5) For radiation sources, such as radioactive strontium and iodine, which deliver radiation predominantly to one organ or tissue, the maximum permissible dose should be established for the tissue or organ that is expected to receive the most radiation.

6) It is not possible at present to monitor the population dose solely by measuring the dose to individuals. Furthermore, any effective control over radiation levels must be directed at the levels of radiation and radioactive materials in the environment. This means that maximum permissible levels will need to be established for such factors as food, water, and air. The levels should be set so that the typical person in the area will not receive more than the established permissible dose when all sources are combined.

7) It is recognized that setting environmental levels involves assumptions and conversion factors to translate these into human body levels. These factors may be expected to change with new information, so the environmental levels

may be expected to require continuous revision even though the maximum permissible limits to the body are not changed.

8) Recommendations regarding a maximum permissible level for medical and dental exposures to the patient are not given because for somatic effects of radiation the possible harm and prospective benefits occur in the same individual in contrast to radiation involving genetic material. The committee urges that continual caution be exercised to maintain radiation for medical and dental purposes at the lowest feasible level.

9) Finally, the committee wishes to emphasize that under one of the primary assumptions made in this report (nonthreshold linear dose response), the biological effect does not suddenly change from harmless to harmful if any permissible dose is exceeded. Any permissible level which may be chosen is essentially arbitrary and every effort should be made to keep the radiation dosage as far below the permissible level as feasible. On the assumption noted above, any radiation dose should be thought of as being tolerated only to obtain compensatory benefits.

Cornelius Packard Rhoads, Leader in Cancer Research

In announcing the death of Cornelius Packard Rhoads, which occurred on 13 August 1959, the Sloan-Kettering Institute described him as "one of the principal pioneers in the development of treatment of cancer by drugs." This was a modest statement indeed. He was, in fact, one of the chief architects of the modern era of cancer research. His attraction to this field was a natural one, from his early training in surgery and pathology and his later connection with the Rockefeller Institute for Medical Research. Two appointments that Rhoads received in 1940 were de-

cisive factors in the shaping of his career. At that time he became professor of pathology at the Cornell University Medical College and director of the Memorial Center for Cancer and Allied Diseases. In 1945 he was appointed director of the newly established Sloan-Kettering Institute for Cancer Research, a research affiliate of Memorial Center. Five years later he relinquished the directorship of Memorial Center to concentrate his energies on the research programs of the Sloan-Kettering Institute.

Rhoads' personal contribution to

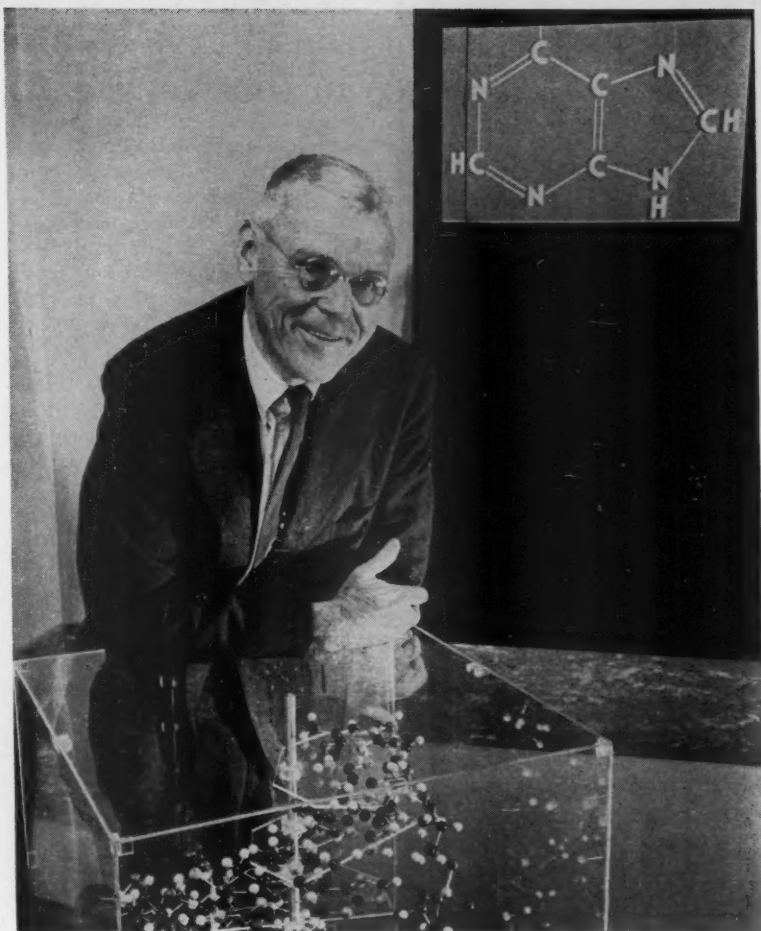
medicine and medical education, and particularly to cancer research, was a tremendous one. Until his death he continued in his appointment as professor of pathology in the department of biology and growth of the Sloan-Kettering Division of Cornell University Medical College. As a member of the National Research Council he served during World War II as a member of its subcommittee on blood substitutes, as a member of its committee on war gas casualties, and as chairman of its blood procurement service. Later he was a member of the Council's committee on veterans' medical problems and committee on atomic casualties. He was a member of the National Research Council's advisory committee on chemical-biological coordination and a member-at-large of its Division of Medical Sciences.

Rhoads served as chairman of the committee on growth of the National Research Council—a group which for several years provided valuable guidance and inspiration for the development of modern cancer research. He

was an early member of the National Advisory Cancer Council of the Public Health Service and later became a member of the Cancer Chemotherapy National Committee which was formed in 1955 to provide guidance for the national, cooperative, voluntary cancer chemotherapy program administered through the Cancer Chemotherapy National Service Center at the National Cancer Institute. He was a member and former director of the American Cancer Society and a member of the special committee on cancer control of the Medical Society of the County of New York. His honors and appointments, and his membership in professional and learned societies, were numerous and distinguished.

Although the extensive, provocative, and highly promising field of chemotherapy took a large share of Rhoads' attention, his interest was by no means confined to this aspect of the cancer problem. He was equally interested in and alert to the importance of such fields as steroid metabolism in cancer, clinical biochemistry of gastric and other forms of cancer, diet in experimental cancer, and anemia. In fact, there was no facet of the problem of neoplastic disease that fell outside the wide circumference of his professional interest.

The Sloan-Kettering Institute for Cancer Research became Rhoads' whole mission. In guiding its course he exhibited an unusual combination of administrative ability, scientific direction, and executive leadership. He had an instinct for finding "the right man for the job" and inspiring him with an enthusiasm for the work that produced remarkable results. He wanted his associates to have the best possible environment in which to live and work. He wanted them to feel encouraged and, above all, to succeed. In order to provide them with the best, he worked hard to develop sound research programs and then to seek support for these programs from whatever private and public resources he could reach. As the captain of a large and diversified research force he saw the large issues and exhibited impatience with trifles.



Cornelius Packard Rhoads

In short, his leadership was of the highest order.

Had Rhoads been allowed time to reflect upon his career before it was so suddenly ended, I can imagine that he might have summed it up with a thought like that expressed in the last words of a "namesake," Cecil Rhodes: "So little done—so much to do." Yet he could not deny, in all modesty, the magnitude of his own accomplishments and the importance of his guidance and counsel in shaping the modern era of cancer research. There is, in truth, much to do—so much, in fact, that the task is a staggering one to contemplate.

It will be done under the courageous and imaginative leadership of men like "Dusty" Rhoads. We will find them among those whose growth in stature is nourished by his example. For Cornelius Rhoads will emerge in the fullness of time as the dominant figure of an era of unprecedented importance in the centuries-old battle against one of the worst scourges of mankind. The ultimate victory will be no less his than ours.

JOHN R. HELLER

National Cancer Institute,
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Bethesda, Maryland

Science in the News

Repeal of the "Non-Communist" Affidavit in the Education Act To Be a Lively Issue in Congress

A bill has been introduced in the Senate that would repeal the controversial provision in the National Defense Education Act which requires every student recipient of a federal loan to execute not only the traditional oath of allegiance but also an affidavit disclaiming belief in or support of any organization advocating illegal overthrow of the government. The bill to repeal the disclaimer or "non-Communist" affidavit was offered on 27 January by Senator John F. Kennedy (D-Mass.) and Senator Joseph S. Clark (D-Pa.), who were joined in sponsorship by Senator Jacob Javits (R-N.Y.).

The new proposal (S. 2929) is a modification of the Kennedy-Clark measure introduced last session (S. 819), which recommended repeal of both the loyalty oath and the disclaimer affidavit required in Section 1001(f) of the Education Act. Although there has been widespread protest throughout the academic community against the disclaimer, there has been little opposition to the loyalty oath.

Objections to Affidavit

These are some of the objections to the affidavit.

It is unnecessary. As Kennedy has pointed out, why should a student be required to swear that he is loyal as well as that he is not disloyal?

It is discriminatory, implying that students are less reliable than others who receive government assistance, such as businessmen, farmers, homeowners, and veterans and their dependents.

It is ineffective, for no Communist would hesitate to take either the oath or the affidavit.

It is unconstitutional, because the

First Amendment of the Constitution guarantees freedom of belief. President A. Whitney Griswold of Yale University said recently in a *New York Times* article that the disclaimer affidavit "extends beyond the basic laws of the land into the realm of belief and conscience, where definitions are vague and actions become matters of debate."

It defeats the very purposes of the Education Act, as President Nathan Pusey of Harvard has pointed out, "by keeping especially conscientious students from the Act's benefits."

It results in government interference in institutional affairs, for educational institutions are obliged to secure the required affidavit as a prerequisite to granting a loan or recommending a candidate for a fellowship. This is considered by many to be government interference in an area of administration that belongs without restriction to free institutions of higher learning.

Protests Widespread

Some 60 colleges and universities have formally protested against the disclaimer provision in the National Defense Education Act. Six institutions have refused from the beginning to participate in the Act's program because of it. They are Bryn Mawr, Haverford, Mills, Princeton, the University of Richmond, and Swarthmore. Fourteen others participated and then withdrew: Amherst, Antioch, Bennington, Goucher, Grinnell, Harvard, Oberlin, Radcliffe, Reed, Sarah Lawrence, St. John's (Md.), Wilmington (Ohio), Yale, and Wellesley. Approximately 40 institutions—the most recent, Vassar, on 13 February—have protested against the affidavit although they have remained in the program.

In addition, statements of opposition have been released by about a dozen professional associations, including the AAAS, the American Association of

University Professors (which led a pioneering campaign against the measure), the American Council on Education, and the National Education Association.

Even students themselves are organizing to combat the issue. The Harvard *Crimson*, a college daily, has published a 15-page pamphlet of protest titled "Worse Than Futile." The pamphlet, which has an introduction by Senator Kennedy, has been distributed at 1200 colleges and universities.

Harvard has a faculty-student repeal committee which has been leading a letter-writing campaign at Harvard and at other institutions. It is reported that the committee persuaded more than 2000 undergraduates to send cards and letters to their congressmen during examination week last month. The University of Chicago, Antioch, and Radcliffe are said to be planning similar campaigns.

The public figures who have endorsed repeal of the measure include T. Keith Glennan, director of the National Aeronautics and Space Administration; Arthur S. Flemming, Secretary of Health, Education, and Welfare, whose agency administers the Education Act program; and President Eisenhower, who showed how important he considers the issue by discussing it in his budget message on 18 January. The President said that the disclaimer affidavit is "unwarranted, and justifiably resented by a large part of our education community, which feels that it is being singled out for this requirement."

Issue in Both Houses

Despite this weighty public support, Kennedy's new bill, S. 2929, will meet lively opposition on the Senate floor, where it will probably be discussed early in March. The proposal was reported out on 2 February by the Senate Labor and Public Welfare Committee, which approved the measure by a vote of 12 to 3—the same majority by which it approved S. 819 last session. The latter was recommitted to committee after a debate during which Senator Russell B. Long (D-La.) said:

"Are we going to make conditions such that it will not be possible to convict a man who is a Communist, who is taking money from the Government and taking advantage of all the things which the Government offers? Somewhere along the line there may be an opportunity to prosecute him. We have

AAAS Meeting Site Changed: New York, Not Philadelphia, To Be Host This Year

The location of the 1960 AAAS annual meeting, to be held 26-31 December, has been changed from Philadelphia to New York.

In June 1955, the Board of Directors selected sites for the Association's annual meetings for the years 1959-62 and decided on Philadelphia for 1960. Accordingly, a request to the local convention bureau for adequate accommodations was made, and acknowledged, shortly thereafter. Unfortunately, at a later date, another large convention was booked in Philadelphia for 26-31 December, on the assumption that there would still be adequate facilities to accommodate the AAAS. This other commitment, which made one large and two smaller hotels unavailable for the AAAS meeting, was not brought to the Association's attention until the time of the recent Chicago meeting.

In January a survey of the remaining hotel facilities and other possible meeting rooms throughout Philadel-

phia made it clear that, while a meeting could be held there, it would be an extremely inconvenient one: The exhibits would have to be located either in the Convention Hall, 2 miles from the downtown hotels, or in the lobby and lower-level Garden Terrace Room of the Benjamin Franklin Hotel; the AAAS presidential address and reception would have to be held in the Academy of Music, blocks away; and at least half the concurrent sessions on days when the schedule was heaviest would have to be assigned to medical classrooms, company recreation rooms, courtrooms, and perhaps department-store fashion rooms. Quite possibly there would have been a scarcity of hotel bedrooms.

Though last-minute changes in location are never desirable, the Association decided to look for a more adequate and convenient meeting site. Fortunately, the Grand Central zone of New York City was open, and the AAAS Executive Committee

has voted unanimously to hold the 1960 meeting there.

All the facilities of the Commodore, Biltmore, Roosevelt, and Belmont Plaza hotels, and a large part of the facilities of the Waldorf-Astoria, are available for this year's convention. In the first four, uniform flat rates of accommodation will be as follows: single room, \$8.50; room with double bed, \$14; room with twin beds, \$15.50. The Waldorf has reserved at least 400 rooms at the following flat rates: single room, \$10; room with double bed, \$16; room with twin beds, \$18. Since the five hotels are well equipped and grouped in the area around Grand Central Station, a particularly convenient and comfortable meeting is assured.

Rockefeller Center, the many new buildings of Park Avenue, and the Fifth Avenue shops are all within easy walking distance, and those who attend this year's meeting will find a wide variety of things to see and do before and after the sessions.

the opportunity to provide for it now."

This is one of the more usual opposition arguments. Defenders answer by saying that laws already exist under which it is possible to prosecute a person who advocates overthrow of the government. Nevertheless, Senator Karl E. Mundt (R-S.D.) is expected to offer an amendment under which there would be no inquiry into belief as such—thus meeting the issue of constitutionality—but under which an active Communist party member could be prosecuted.

Opposition to repeal of the disclaimer affidavit is expected to be greater in the House than in the Senate. Although eight repeal bills have been introduced in the House, there has been no action. All of the bills have been referred to the House Education and Labor Committee, whose chairman, Representative Graham A. Barden (D-N.C.), said emphatically a year ago: "I will resist with everything that is within me the removal of that provision." He also commented that the academic community was "interested in the money, then they want to raise a great howl about taking

an oath of allegiance to America."

Another influential member of the House committee, Representative Carl Elliott (D-Ala.), who is chairman of the Special Education Subcommittee, to which the repeal bills have been assigned, stated publicly only a few weeks ago that he "wasn't worried" about the few schools opposed to the affidavit and had no plans to schedule hearings.

In contrast, the administrator of the federal student-loan fund, John F. Morse, said as long ago as mid-November that if more colleges dropped out, this could lead to "destruction of a magnificent program." He expressed sympathy with the reasons given by institutions for withdrawing, but he pointed out that the Education Act was passed for the benefit of needy students, not for the benefit of institutions, and observed: "Wealthy institutions may well provide these benefits from other sources, but there are a number of institutions which, if they were to take the stand Harvard, Yale and others have taken, would literally force students out of college."

The precedent for the Education Act's non-Communist affidavit may be found in the National Science Foundation Act of 1950, from which the present controversial provision was copied. The foundation administers its own fellowship funds—and loyalty-oath provisions—whereas educational institutions must process the applications for Education Act funds. To date, more than 12,000 applicants have signed the NSF affidavit to qualify for graduate science fellowships, and there has been no organized protest from the scientific community.

President Explains New United States Test Ban Proposal

The following is the text of a White House statement on the new United States proposal for a ban on nuclear weapons tests. The proposal, which the Soviet Union is reported to have labeled "unacceptable," was formally presented at the Geneva test-ban conference on 11 February.

The United States representative at the Geneva conference on the discontinuance of nuclear weapons tests is presenting today a proposal for the ending of nuclear weapons tests in all the environments that can now be effectively controlled.

The new United States proposal would ban all tests above ground up to the greatest heights to which effective controls can now be agreed, all tests in the oceans, and all underground tests above the present limit (or "threshold") of detection and identification.

At the same time the proposal includes provision for a program of joint research and experimentation by the United Kingdom, the Union of Soviet Socialist Republics and the United States to improve the detection of small tests under ground and thus permit the extension of the ban to such tests. Extensive research and experimentation is already under way in the United States to improve detection instruments and techniques.

Would Allay World Concern

The new approach, if agreed to, should allay world-wide concern over possible increases in levels of radioactivity, since it discontinues all tests which can release radioactivity into the atmosphere.

As for underground tests, the proposal represents an effort to find ways around the significant disagreements that remained unresolved in the technical working group which reported to the conference in December. The proposal would ban those tests which cause seismic magnitude readings of 4.75 or more. This is the level that can now be adequately monitored. We propose to express the level in terms of signal strength, since Soviet and Western scientists are in substantial agreement as to the measurement of signals but not on the equivalent kiloton yields of seismic disturbances.

The United States, since the inception of the Geneva conference on the discontinuance of nuclear weapons tests, has persistently sought a lasting, safeguarded agreement banning all nuclear weapons tests. We have, at the same time, indicated willingness, as in our proposal of May 5, 1959, to move immediately to consolidate in a first step agreement, the broadest existing area of agreement while remaining difficulties are being worked out.

Major Difficulties Unresolved

With the failure to reach agreement after the technical conference which ended on Dec. 19, 1959, it became clear that a controlled, comprehensive agreement could not, at this time, be achieved without great improvement in instrumentation or a degree of on-site inspection which would be impractical to attempt. Lack of agreement at this conference has left unresolved major technical difficulties in detecting underground explosions as well as the procedures that must be established if on-site inspections are to be satisfactorily initiated and carried out.

In this situation, the United States is determined to make all possible progress toward the ultimate objective of the negotiations. We believe that the proposal placed before the conference today, if entered into in good faith by the parties concerned, will lead toward eventual prohibition of all nuclear weapons tests under the practical and adequate safeguards that we deem as indispensable prerequisites.

If accepted, the proposal will end forthwith, under assured controls:

- (1) All nuclear weapons tests in the atmosphere;
- (2) All nuclear weapons tests in the oceans;
- (3) All nuclear weapons tests in those regions in space where effective controls can now be agreed on; and
- (4) All controllable nuclear weapons tests beneath the surface of the earth.

Further Extension Expected

Moreover, it will permit, through a joint program of research and experimentation, the ban to be systematically extended to remaining areas under ground, where adequate control measures are not now possible to incorporate.

These are initial, far-reaching, but readily attainable steps. They are steps which offer an opportunity to consolidate the important progress made in the negotiations thus far. These steps will also allay worldwide concern over possible increases in levels of radioactivity. More importantly, they will greatly enhance the prospects for future international arms limitation and control agreements.

It is our hope that the Soviet Union, in the light of a reasoned and objective appraisal of the facts, will join with us

in this constructive beginning. Such an agreement could be a milestone toward the securing of a just and enduring peace.

Filmed High-School Biology Course Offered by AIBS

A complete modern high-school biology course in color motion pictures has been introduced by the American Institute of Biological Sciences (2000 P St., NW, Washington 6, D.C.). The course will be available for use in American classrooms next September.

Planned and in production for more than 2 years, the film series embodies content recommended and approved by nearly 200 of the leading contemporary biologists and by members of professional organizations representing the great majority of America's biology teachers. These organizations include the AIBS, the National Association of Biology Teachers, and the National Science Teachers Association.

Portions of the course already have been pretested by 200 teachers with classes totalling 7000 pupils in large, small, urban, rural, public, and private high schools in all parts of the country. Hidden T. Cox, executive director of the AIBS, announced. "The overall response of these young people has been tremendous," Cox said. "Some changes were made as a result of the pretesting, but there are overwhelming indications of comprehension and learning through the films."

Use of Course Explained

The course employs modern instructional media and imaginative use of filmed material, including inserts showing prominent biologists and leading biological laboratories and field stations and inserts of portions of outstanding American and foreign research films. The inserts include cinemicrographic film, still photographs, and animated sequences.

A total of 120 films, each of 30 minutes' length, makes up the course. Each film is basically of the lecture-demonstration type. The complete package of 120 provides a full year of high-quality instruction (recommended usage is for not more than three films to be shown in any 1 week). Smaller units of 12 films on major areas of biological knowledge, or individual films



European Organization for Nuclear Research establishment at Meyrin, Switzerland. The T-shaped building in the foreground and the circular underground structure behind it house the new proton synchrotron, largest of its kind.

on specific subjects, will also be available to teachers to meet individual needs.

H. Burr Roney, project director and principal teacher in the filmed course, said it has been designed to be so flexible that any school may make use of it. While a small school with no teacher or facilities for biology instruction might use the series to advantage, the course, as planned, has four principal components—the classroom teacher, the films, a teacher's manual, and a study guide. The last two items are provided as integral parts of the course.

Roney commented, "We hope this series will make the best type of biological instruction available to every school in the nation. Our series is not intended in any way to replace the teacher—far from it. It is designed to fit into any program which any teacher uses."

Content Described

The inserted sequences, which make up more than 15 percent of the total footage, range from scenes of marine life in the West Indies to pictures of a University of California virus laboratory. They include presentations of living plant and animal forms in forest, marine, mountain, desert, and prairie environments, so that botanical, zoo-

logical, and ecological material not readily available in the classroom may be studied.

Emphasis throughout the AIBS course is on modern biology. Recent advances in radiation biology are stressed.

Over-all supervision of the content of the course has been a function of the AIBS committee on education, headed by Oswald Tippo, chairman of the department of botany at Yale University and former president of the Botanical Society of America. This committee, since pre-Sputnik days, has initiated a succession of far-reaching projects to improve and vitalize American education in the biological sciences at all levels.

The new film series was prepared with the support of the Fund for the Advancement of Education of the Ford Foundation and the Atomic Energy Commission.

Largest Proton Synchrotron Goes into Operation

The new 25-Bev alternating-gradient proton synchrotron of the European Organization for Nuclear Research, Meyrin, Switzerland, went into operation on 5 February. The facility has

a large, T-shaped main laboratory building, auxiliary structures, and a wheel-shaped underground installation, about 656 feet in diameter, in which protons are accelerated up to 99.93 percent of the speed of light. Thirteen Western nations financed and built the \$30-million center, which is open to scientists from all the participating countries and from some others, including India, Australia, and Israel. At present, this is the largest accelerator of its kind; however, a still larger installation is to be finished soon at the Brookhaven National Laboratory.

Scientists in the News

Herbert E. Longenecker, vice president of the professional colleges of the University of Illinois, has been appointed president of Tulane University. He is a specialist in the field of biochemistry and nutrition and a member of the technical advisory panel of biological and chemical warfare of the Department of Defense. He replaces **R. C. Harris**, who is retiring to become president of Mercer University, Macon, Ga.

Sara E. Branham, currently participating in the visiting biologist program

of the American Institute of Biological Sciences, has been named Medical Woman of the Year by the Washington, D.C., branch of the American Medical Women's Association. She retired as chief of the section on bacterial toxins at the National Institutes of Health last July, after 30 years of work for the Public Health Service.

Fred S. Orcutt, acting head of the biology department of Virginia Polytechnic Institute, has been named department head.

Hans Selye, professor and director at the Institute of Experimental Medicine and Surgery of the University of Montreal, has been named the first recipient of the Samuel Charles Miller Memorial Award by the American Academy of Dental Medicine for his contributions to the "art and science of dental medicine."

Robert N. DuPuis has been named vice president for research of General Foods Corp., Tarrytown, N.Y. He will remain on the board of directors of Philip Morris, Inc., where he has been vice president for research and development.

John W. Findlay, head of the department of research equipment development at the National Radio Astronomy Observatory, Green Bank, W.Va., has been made assistant to the director of the observatory.

Antonio H. Romano, former instructor in microbial biochemistry at Rutgers University, has been named associate professor of bacteriology in the McMicken College of Arts and Sciences of the University of Cincinnati.

James C. Sternberg, assistant professor of chemistry at Michigan State University, has been appointed senior research chemist of the scientific and process instruments division of Beckman Instruments, Inc., Fullerton, Calif.

Herald R. Cox, director of virus research at Lederle Laboratories Division of the American Cyanamid Co., has been elected president of the Society of American Bacteriologists.

Three scientists from Australia will visit the United States in the near future.

D. J. Tranter, research officer in the division of fisheries and oceanography

at the Marine Laboratory in Sydney, will arrive 22 February to spend four and a half months at the Woods Hole Oceanographic Institution.

C. N. Watson-Munro, thermonuclear physicist at the University of Sydney, will begin an 8-month assignment, in February, at the Lawrence Radiation Laboratory of the University of California, Berkeley.

A. B. Whitehead, a research officer at the Chemical Research Laboratories in Melbourne, will arrive 20 February to study the application of the fluidized-bed technique to metallurgical problems. He will leave for London on 3 April.

Raymond E. Marsh, a former assistant chief of the Forest Service of the U.S. Department of Agriculture, has been awarded the Order of the White Rose of Finland for his work in making Finnish forestry techniques known in the United States. In 1958 he was similarly honored by the government of Sweden.

Frederick J. Doyle, associate professor of photogrammetry and chairman of the division of geodetic science at Ohio State University, has been appointed director of photogrammetric and geodetic research with the Broadview Research Corp., Washington, D.C.

Arthur C. F. Gilbert, psychologist and former director of the counseling service at Princeton University, is now clinical psychologist at the mental hygiene clinic of the United States Air Force Academy, Colo.

Herman Feifel, on leave from the mental hygiene service of the Veterans Administration, Los Angeles, Calif., is spending 1960 at the Research Center for Mental Health of New York University.

Ronald A. Fisher, statistician and geneticist of Cambridge University, has been lecturing at the University of Wisconsin during February. Among other topics he has discussed the relation of smoking to cancer.

Peter B. Medawar, Jodrell professor of zoology at the University of London and an authority on body reactions to transplanted tissues, will deliver the annual Dunham Lectures at Harvard Medical School on 21, 23, and 25 March. He has chosen the immunology of transplantation as his general topic.

Recent Deaths

Jesse P. Bogue, Ann Arbor, Mich.; 70; former visiting professor of higher education at the University of Michigan; executive director of the American Association of Junior Colleges from 1946 to 1958; 5 Feb.

Robert P. Celarier, North Little Rock, Ark.; 38; assistant professor of botany at Oklahoma State University; 23 Dec.

Bela Hanka, Toronto, Canada; 72; zoologist in the fisheries library of the department of zoology at the University of Toronto; formerly first director of the Hungarian Biological Institute in Tihany and a member of the Hungarian Scientific Academy; 16 Nov.

Frank G. Haughwout, Washington, D.C.; 62; former consultant to the Armed Forces Institute of Pathology; authority on tropical intestinal diseases; 6 Feb.

James W. McRae, New York, N.Y.; 49; vice president of the American Telephone and Telegraph Co. and coordinator of defense activities for the Bell Telephone System; chairman of the Army Scientific Advisory Panel; 2 Feb.

Frederick G. Merkle, University Park, Pa.; 67; professor emeritus of soil technology at Pennsylvania State University and member of the department of agronomy, 1919-57; 6 Jan.

Robert K. Nabours, Manhattan, Kan.; 84; geneticist; member of the zoology department of Kansas State University for 35 years and head of the department from 1916 to 1947; 6 Jan.

Joseph E. Nickels, Fullerton, Calif.; 47; supervisor of organic petrochemical research with Richfield Oil Corp.; Anaheim, Calif.; 9 Jan.

Bruno Oettking, New York, N.Y.; 88; curator of physical anthropology at the Royal Museum, Dresden (1907-10); assistant at the American Museum of Natural History; 17 Jan.

Herbert L. Spencer, New York, N.Y.; 65; trustee and executive director of the Samuel H. Kress Foundation; former president of Bucknell University, Lewisburg, Pa.; 29 Jan.

Charles W. Waters, Missoula, Mont.; 62; forest pathologist; professor of botany for 34 years at Montana State University.

Erratum. A sentence in the news item on the Navy bathyscaphe's 37,800-foot descent to the floor of the Marianas Trench [*Science* 131, 341 (5 Feb. 1960)] implies that the greatest depth previously recorded, 36,198 feet, had been attained in a similar descent by a Russian vessel. Actually, the Russian figure was an echo-sounding recording, made in August 1957 from the deck of the *Vityaz*.

Book Reviews

Strategy in the Missile Age. Bernard Brodie. Princeton University Press, Princeton, N.J., 1959. vii + 423 pp. \$6.50.

In the nuclear era there is less excuse than ever—if there ever was any—for thinking of strategy as the science of conducting a war that has already started, toward an end that is taken for granted. Strategy must be as much concerned with the *threat* of force as with its application. Deterrence, nuclear blackmail, limited war, accidental war, arms agreements, and the problem of credibility epitomize the modern meaning of strategy.

So defined, strategy is a backward science. We do not even have a rudimentary common terminology to cover the different cases of deterrence that are continually being discussed. In these circumstances, it may underrate Brodie's book to say that it is the best available. There are remarkably few good books on strategy, and even few books at all. Part of the reason is beautifully laid out in Brodie's early chapters. This is an "intellectual no-man's land," traditionally avoided by the military who have shied away even from strategy in the more restricted sense. It is equally true, Brodie points out, that the civilian side of government has been reluctant to equip itself to deal with strategy.

There is nothing very strange about this. We do not expect business executives to produce management science or navigators to produce astronomy; and we should not expect military officers, whose jobs require them to be executives, engineers, bureaucrats, and leaders of men, to produce a body of theory. It may well be the lack of an academic counterpart to the military profession that explains the slow development of strategy. Part 1 (about 150 pages) is a perceptive and absorbing review of the role of strategy and strategists from Napoleon to the Strategic Bombing Survey, with particular

emphasis on air strategy during the period since World War I.

Brodie's book is at once the most advanced comprehensive treatment of strategic problems and the closest thing to a textbook in a discipline so unorganized that it lacks even this mark of respectability. Part 2 (roughly 250 pages) is a knowledgeable, balanced, and responsible discussion of current strategic issues as they involve the long-range striking forces of the United States. (This includes limited war, but principally in its relation to the strategic background—a background that ordinarily receives too little emphasis.)

Part 2 may not contain much (except evident wisdom) that is altogether novel to anyone who has kept up with what little good literature has been produced in recent years, a literature to which Brodie himself has been a main contributor. Issues that can be discussed within 250 pages, even lucid and well organized pages, are bound to sound pretty basic and familiar to professionals, unless the author has some favorite gimmicks. Brodie has no gimmicks. But press conferences, congressional hearings, and the writings of military commentators so rarely come up to the intellectual level that can be achieved within the scope of 250 intelligently written pages that Brodie's book might be considered advanced reading. For the nonprofessional, whose stake in these matters is only his life and civilization, *Strategy in the Missile Age* is intellectually accessible, written with a dignity and good taste that inspire confidence in the author's sense of responsibility, and enlightened by a rare touch in the use of historical perspective. (The introduction is a masterpiece.)

If a distinguishing theme or message has to be singled out, it is that the most urgent problem, now and continually, is to ensure the invulnerability of our strategic retaliatory forces, which cannot deter an attack on the United States if they can be destroyed in the

act they are intended to deter, and which can hardly rely on anticipating an attack and retaliating in advance. Brodie's main premise is that general war is possible, terribly possible if our strategy is poor, because the technology of modern surprise attack may not make the initiation of general war anything like suicide unless the side being struck has taken this problem seriously, and because the very fear of being second might at some time make going first seem a conservative policy for the enemy, unless he knows that our strategic forces need not strike first to avoid their own destruction. In the last 12 months or so, this concern has spread rapidly in the United States, but the opposite view was widely taken for granted scarcely 2 years ago.

To those who, influenced by the accounting practice of modern press conferences, already think of Atlas as yesterday's weapon, or to whom the commissioning of the first ballistic-missile submarine (without its missiles) makes land-based weapons uninteresting, the book may seem old fashioned. It even discusses airplanes. But anyone worried about the several years we must live through next, and interested in decisions still to be taken for the years after that, will find the analysis not only timely but a reminder that we cannot get beyond the near future without living through it. And before anyone anticipates the early obsolescence of Brodie's analysis he should reread Brodie's own chapters in *The Absolute Weapon*—a book he edited less than a year after Hiroshima, chapters that looked way over the horizon into the nuclear era. His record is awfully good.

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Methods of Experimental Physics. vol. 6, *Solid State Physics*. Part A: Preparation, structure, mechanical and thermal properties. xvi + 466 pp. \$11.80. Part B: Electrical, magnetic, and optical properties. xiv + 416 pp. \$11. K. Lark-Horovitz and Vivian A. Johnston, Eds. Academic Press, New York, 1959. Illus.

In this 900-page, two-part volume something is said about the techniques for making essentially all physical measurements in solid state physics. Each of the 68 experts contributing to

the volume has written a chapter attempting to cover his own field. Since this averages out to 13 pages for each contributor, most techniques can only be treated superficially. Nevertheless, enough references are cited so that anyone undertaking to make a measurement in solid state physics will find this volume a good starting point. Although there is no other book like it in the field, I cannot recommend it for individual purchase since only a small fraction of the volume is devoted to the average experimentalist's problems. However, any library utilized by about four or more experimental solid state physicists can favorably consider its purchase.

Because of the brevity of each chapter, this volume will be of limited use to the researcher who must decide what experimental technique can best be applied to his problem, but having chosen a technique, he can well begin his literature survey here. While the foreword to the volume states that "Indications of limitations of both applicability and accuracy are an important part of this presentation," this intention is fulfilled only in the outstanding chapters, for many chapters fall far short of yielding any such indications. In addition, a newcomer to a field will glean little information concerning the accuracy generally obtainable by various experimental methods.

The book appears to be well edited and fairly complete in broaching experimental solid-state measurements. It is an important contribution in its field.

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The Lost Cities of Africa. Basil Davidson. Little, Brown, Boston, 1959. xvi + 366 pp. Illus. \$6.50.

Africa. Its peoples and their culture history. George Peter Murdock. McGraw-Hill, New York, 1959. xiii + 456 pp. Illus. \$11.75.

Both George Murdock and Basil Davidson write about the pre-European periods of Africa, but their books are quite different. Since the latter's book is of the more familiar genre, perhaps it would be best to discuss it first. Basil Davidson, a journalist with a long time interest in African archeology, attended both conferences on African history and archeology at the School of Oriental and African Studies (1953, 1957),

and he gives us a useful popular survey of archeological research on the entire continent. This is very welcome, especially since, aside from the reports of the above conferences, rather more dryly written, and a slight book in French by de Pedrals, there is nothing of this sort on a continental scale, and even regional surveys, where they exist, are apt to be out of date.

Archeological reports are difficult for the layman to read, and since no archeologist has seen fit to provide a summary of African excavations for the general reader, Davidson is to be congratulated for undertaking a task that many must have shrunk from because of its magnitude and because interpreting a field in which the material is still scanty presents many pitfalls. So far as I can judge, he has come through well, and for areas where I am familiar with the original reports, he has adhered scrupulously to the data. I am afraid that some readers may have doubts on this because of the style of the book. The author's earlier books are mostly of a polemic and political nature, and archeology does not lend itself so well to polemics. Davidson wishes to demonstrate that the African has produced some cultural accomplishments, and even though there are many benighted readers who do not understand this, it is not as radical a statement as the author seems to think. If it is not yet "old hat," at least it does not bear repeating so often in a book of this kind. The effect may be to make the archeology seem to be the appendage of the argument rather than the other way around and, thereby, to raise doubt concerning the veracity of the actual data. This would be unfortunate.

The literature on the kingdoms of the western Sudan is quite extensive, and A. J. Arkell's writings provide an adequate account of the eastern Sudan, but Davidson adds an interesting chapter on the middle region in between. The "Azanians," still very much of a problem even as to identity, are discussed. Zimbabwe is reviewed, and other well-known and many less-known ruins pass before the kaleidoscope. Davidson has made his book indispensable to students of the general history of Africa.

Africa is based in large part on a method that has been relatively little employed for historical reconstruction, and never, to my knowledge, on such an extensive scale. Murdock has attempted to trace the spread of domesticated plants from known places of origin to

their present distribution. Since agriculture is the basis of the Neolithic culture on which all subsequent civilization is built, there is a good rationale for this approach.

Other kinds of data, particularly linguistic data are used for historical inference, but these data seem to come in unevenly. It could, in fact, be argued that the book would have been more effective, or that it would at least have had a clearer line of argument, if it had been restricted to a consideration of plant "cultigens." The present state of knowledge makes it well-nigh impossible to bring together the various types of materials that might be useful in historical study of the African peoples; therefore, we need laudable onslaughts on a particular kind of material, such as Murdock has made on the botanical data, until we have a series that can be compared and cross-checked and, finally, interwoven. When one method is used extensively and another scantily, the impression is created, erroneously perhaps, that the minor thread is used only when a crutch or a sign-post is needed, or when a bit of evidence is too well known to be ignored.

This is the feeling that arises when we are told that the spread of the Bantu-speaking peoples was made possible by plants of Indonesian origin that came onto the continent on the Indian Ocean coast and then moved across the continent on the northern fringe of the forest before being used as a means of penetrating the forest *from the west*. Greenberg's classification of African languages leads to the conclusion that the people of Bantu speech originated in the Cross River-Benue region (Nigeria). Therefore, the plants *had* to go westward north of the forest; otherwise the speech of the forest peoples would have a different affiliation. Was this the reasoning? We would like to know whether the interpretation came strictly on botanical grounds or on linguistic, but it is impossible here to disentangle them. Had Greenberg delayed his classification until after this study had been made, and considering Harry Johnston's dictum that the Bantu originated in the area of the East African lakes, would we have been told that the Indonesian complex of plants began its penetration of the forest in the east? As an explanation of plant distribution, it is the simpler one, but it is not now compatible with the necessary explanation of language distribution. One would like to have a clearer

statement of the process by which the conclusion was reached.

Not the least contribution of these books is stimulating discussion in a field too often neglected by scholars in this country. That much more research needs to be done on many levels is evident; this is indicated, for example, by the surprisingly few points of contact in these two presentations or, for that matter, between either of them and D. Westermann's *Geschichte Afrikas*.

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Principles of Optics. Electromagnetic theory of propagation, interference and diffraction of light. Max Born, Emil Wolf *et al.* Pergamon Press, New York, 1959. xxvi + 803 pp. Illus. \$17.50.

It is gratifying to have Max Born's *Optik* now translated and revised. *Optik* and its successor, by Born and Wolf differ enough, with some topics enlarged and others restricted or omitted, that the authors can claim they have written "a substantially new book." It is not my intention to repeat the table of contents here, but to give some reasons why I think the new book will become a great book. In addition to Born and Wolf, A. B. Bhatia, P. C. Clemmow, D. Gabor (holograms), A. R. Stokes, A. M. Taylor, P. A. Wayman, and W. L. Wilcock contributed to the volume. Their contributions may be identified by reading the preface.

The sections on dispersion, the geometrical theory of image formation and aberrations, the physical theory of diffraction and aberrations, and the treatments of interference and diffraction with monochromatic and partially coherent light are all excellent.

The treatment of periodic film structures (to which F. Abeles and B. H. Billings contributed) will be helpful to the inventors who have yet to create the new applications of stratified media that the future holds (such as reflection filters for use in the far infrared).

The coverage of topics of current interest, such as diffraction and partially coherent light, will please the reader interested in theory; the chapters on image-forming instruments and on interference and interferometers will be approved by those who apply optics.

And yet there are, inevitably, some disappointments, such as the inadequate

treatment of Savart's plate and the absence of a discussion of apodizing. I missed items such as the Lyot polarization filter. Topics in which the atomic and molecular nature of matter play a decisive role are treated in the "new book" in terms of Maxwell's phenomenological theory. Thus, much of the original text, especially spectroscopy, is omitted in this volume. Planck's celebrated formula appears only as $K(\nu, T)$.

The writing, generally good, is sometimes incomplete—on page 24 the authors do not explicitly define the problem they solve so beautifully. The book has a good balance between examples and word pictures, on the one hand, and esoteric analysis, on the other. It is embellished by two dozen handsome halftones and an abundance of conventional line drawings. In the areas covered, the book treats the right subjects at the right level (for reference use).

Finally, the authors have retained the flavor and inherent stimulation of the original sources in their treatment of many topics, and the citations to those sources will afford an excellent bibliography for the scholar who is expanding his knowledge.

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Nicholas Biddle. Nationalist and public banker, 1786–1844. Thomas Payne Govan. University of Chicago Press, Chicago, Ill., 1959. xii + 429 pp. \$7.50.

As its author points out, this is not a full biography of Nicholas Biddle: "It is in biographical form, but it is not a full story of Biddle's life. I have written of him as nationalist and public banker, for it is here, in my opinion, that his significance lies. I could not write of him as son, husband, parent, private citizen, or even as a man without having these remarks appear as irrelevant intrusions into the already too complex narrative" (page ix). There are brief discussions of other aspects of Biddle's life: his boyhood; his brilliant record as a student at Princeton; his literary interests and activities, including his editing of the Lewis and Clark journals; his experience as secretary to the American ambassador to France and as a traveler in Europe and the Near East; his court-

ship and happy marriage; his brief career as a lawyer; and his term as a member of the Pennsylvania legislature. But the central interest of the book is in Biddle's role as head of the great Second Bank of the United States, the political controversies centering on the bank and its policies, and the dramatic conflict between Biddle and Andrew Jackson.

In preparing this volume, Govan has drawn not only on published materials but also on masses of official papers and Biddle's copious correspondence. The result is an interesting and important book which sheds much new light on Biddle, the Bank, and the controversies surrounding them. It now becomes even clearer than it was before that Biddle recognized fully the powers of the Bank and was highly sophisticated in his use of those powers. He was, of course, interested in the commercial activities of the Bank and in promoting its profitability. But his deeper interest was in the Bank as an instrument of national policy, and he deliberately used its central banking powers to promote the national interests as he, and many others, saw them. Some of the actions that he took deliberately to influence the state of the credit markets, the behavior of business activity, and the nation's balance of international payments evidenced both boldness and an understanding of central banking principles quite rare in his time.

This book is destined to be highly controversial, for its verdict is almost completely favorable to Biddle and wholly adverse to Jackson. Those who seek to reverse this verdict, and they will probably be numerous, will face formidable evidence.

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Soviet Research in Crystallography, 1956. English translation. Consultants Bureau, New York, 1959. 77 pp. Illus. \$10.

This is the third volume in a series that was inaugurated two years ago [reviewed in *Science* 129, 324 (1959)]. We are told in the preface that the volume contains English translations of papers selected from six Russian chemistry journals; evidently the contents of the previous volumes were also restricted to the same sources. These

journals, which have been completely translated into English, in a continuing project by Consultants Bureau, are the following: *Journal of General Chemistry of the U.S.S.R.*; *Journal of Applied Chemistry of the U.S.S.R.*; *Journal of Analytical Chemistry of the U.S.S.R.*; *Colloid Journal*; *Bulletin of the Academy of Sciences, U.S.S.R., Division of Chemical Science*; *Proceedings of the Academy of Sciences, U.S.S.R., Chemical Technology Section*.

The selections in this volume comprise 17 papers covering a wide variety of topics. Nevertheless, the range is more restricted than that of the first two volumes, and all of the papers incorporate some aspect of crystallographic or diffraction technique. The emphasis is still on inorganic chemistry, and there are no novel contributions to the field of crystallography itself. Nevertheless, within the restrictions set for this volume, the selection is fairly reasonable and fulfills the aim of providing a supplement to the main body of Soviet publications in crystallography, which is available in translation elsewhere.

The volume is printed in offset in the same form as the first two volumes, but the editing and composition have perhaps been somewhat improved.

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Progress in Industrial Microbiology. vol. 1. D. J. D. Hockenhull, Ed. Interscience, New York, 1959. 248 pp. Illus. + plates \$8.

This is the first volume in yet another attempt to review, annually, the large amount of current and past literature on selected topics in industrial microbiology. The six subjects covered include several on antibiotics. Hockenhull briefly discusses penicillin formation by fermentation, including the role of corn steep liquor, salts of organic acids, lipids, and other nutrients. Most of the paper deals, however, with the biosynthesis of penicillin, and it is largely a speculative and interesting essay on the possible routes to penicillamine. The tetracyclines are discussed by Di-Marco and Pennella under the misleading title "The fermentation of the tetracyclines," which implies decomposition

rather than biosynthesis. Many of the details concerning the preparation of inoculum, the composition of fermentation media, and other cultural conditions could be obtained only from the patent literature which often lacks specificity and completeness. On the whole, however, the review contains much useful information on the historical background and current microbial methods of producing the various tetracyclines.

The microbiological assay of antibiotics, vitamins, and amino acids is reviewed by Sokolski and Carpenter. An introductory statement that "No form of life has completely unique metabolic or functional processes" is not entirely correct since chemoautotrophic bacteria are unique in their ability to utilize energy liberated from the oxidation of inorganic compounds. The microbial assays for vitamins and amino acids are covered in a superficial and incomplete manner. There is little or no discussion of specificity, free and bound forms of vitamins, methods for liberation of bound forms, and so forth. But antibiotic assays are dealt with in great detail, and there is an extensive treatment of the theory and statistical analysis of agar diffusion assays.

In a paper certain to be controversial because of the nature of the subject, Bisset presents his views on the taxonomy of the Actinomycetes, a group which includes the important producers of antibiotics, the *Streptomyces*. Bisset concludes that the classification of the Actinomycetes is still inadequate for purposes of recognition and identification, partly because potentially valuable morphological structures, such as the sporophores, have not been adequately studied.

Goodwin describes the various yeasts, molds, and bacteria which synthesize appreciable quantities of riboflavin and also the media and cultural conditions which affect riboflavin production. These aspects are followed by a good review of the present knowledge of the biosynthesis of riboflavin.

In the final paper of the series, Woodbine presents a very extensive review, somewhat overburdened by details, of fat production by microorganisms. The microorganisms involved, the effect of cultural conditions on fat yield, the chemical nature of the fats, biosynthetic pathways, and the possible use of microbial fat as food are discussed. Woodbine concludes that fat

production by microorganisms is technologically feasible but that microbial fat cannot as yet compete economically with animal and vegetable fats.

The reviews should be of considerable value to microbiologists and to others working in related fields. It will be interesting to learn to what extent the present series will be complemented by a similar series *Advances in Applied Research*, published by Academic Press.

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New Books

Advances in Space Science. vol. 1. Fredrick I. Ordway, III, Ed. Academic Press, New York, 1959. 424 pp. \$12.

Mathematical Methods and Theory in Games, Programming, and Economics. vol. 1, *Matrix Games, Programming, and Mathematical Economics*, 443 pp.; vol. 2, *The Theory of Infinite Games*, 397 pp. Samuel Karlin. Addison-Wesley, Reading, Mass., 1959. \$12.50 per volume.

Maya Hieroglyphic Writing. An introduction. J. Eric S. Thompson. Univ. of Oklahoma Press, Norman, 1960 (reproduced from ed. 1, Carnegie Institution of Washington, 1950). 370 pp. 64 plates. \$10.

Paul Ehrenfest, Collected Scientific Papers. Martin J. Klein, Ed. North-Holland, Amsterdam; Interscience, New York, 1959. 169 pp. \$13.75.

Physical Methods of Investigating Textiles. R. Meredith and J. W. S. Hearle. Textile Book Publishers (Interscience), New York, 1959. 420 pp. \$13.

The Placenta and Fetal Membranes. Claude A. Villee, Ed. Williams and Wilkins, Baltimore, Md., 1960. 415 pp. \$10.

Probability and Statistics. The Harald Cramer volume. Ulf Grenander, Ed. Almqvist and Wiksell, Stockholm; Wiley, New York, 1959. 434 pp. \$12.50.

Strahlenbiologie, Strahlentherapie, Nuklearmedizin, und Krebsforschung. 1952-1958. H. R. Schinz, H. Holthausen, H. Langendorff, B. Rajewsky, G. Schubert, Eds. Thieme, Stuttgart, Germany, 1959. 998 pp. \$65.50.

Surveyor of the Sea. The life and voyages of Captain George Vancouver. Bern Anderson. Univ. of Washington Press, Seattle, 1960. 286 pp. \$6.75.

The Survival Book. Paul H. Nesbitt, Alonzo W. Pond, William H. Allen. Van Nostrand, New York, 1959. 343 pp. \$7.50.

Theory of Elasticity. L. D. Landau and E. M. Lifshitz. Translated from the Russian by J. B. Sykes and W. H. Reid. Pergamon, London; Addison-Wesley, Reading, Mass., 1959. 140 pp. \$6.50.

The Theory of Optimum Noise Immunity. V. A. Kotel'nikov. Translated by R. A. Silverman. McGraw-Hill, New York, 1959. 140 pp. \$7.50.

Reports

Water Intake without the Act of Drinking

Abstract. A method is described that allows a rat to ingest fluid through a chronic gastric tube that bypasses the oropharyngeal cavity. In this situation long-term regulation of water intake occurs in normal rats and in the rat with diabetes insipidus. Under special circumstances, a remarkable degree of excess intake can be produced.

Many of the factors controlling food and water intake can be divided into two complex groups by the act of ingestion. Those operating immediately before ingestion, or the preingestion factors, include stimulation of the distance receptors and the chemoreceptors by food and water and sensory feedback from consummatory responses such as sucking, licking, chewing, and swallowing. Sensations from the upper gut, changes in the tonicity of the body fluids, and direct humoral influences upon the central nervous system constitute the second or postingestion group of factors.

Work done during the past two decades with esophagostomized animals has emphasized the important role played by preingestion factors in behavior involving oral ingestion. Bellows (1) and Adolph (2) demonstrated (i) that water-deprived dogs with chronic esophageal fistulae will refuse water for as long as 15 minutes after a draught taken by mouth but lost through the fistula and (ii) that the size of this sham-drunk draught is a remarkably

accurate function of an accumulated water deficit. Janowitz and Grossman (3) have shown that the sham-feeding of hungry, esophagostomized dogs inhibits subsequent eating. And the essential outlines of the preference-aversion curve for salt, a complex form of salt-drinking behavior, can be seen in rats with esophageal fistulae (4). In addition, Teitelbaum's finding (5) that the hypothalamic-hyperphagic rat is over-responsive to the taste and texture of the diet suggests that preingestion factors play a crucial role in this striking disorder of eating behavior.

Long-term studies of voluntary intake in the absence of preingestion factors should contribute to the further understanding of their role in all these phenomena. With this in mind, a chronic gastric tube for rats was developed that is passed through the nasopharyngeal gastric tubes were first and oropharyngeal receptors. Adult, female albino rats carrying such nasopharyngeal gastric tubes were first trained to press a bar to obtain water for ingestion by mouth. A column of tap water 6 feet above the level of the animal's stomach was then lead to the gastric tube through flexible plastic tubing interrupted by a normally closed solenoid valve. The previously learned bar-press then opened the valve and allowed water to run by hydrostatic pressure directly into the animal's stomach. The animal could thereafter control the frequency with which a small amount of water was injected into its own stomach (6). The size of any single stomach load was controlled by the experimenter and was varied by changing the length of time that the valve was held open. This then became the animal's only source of water.

This water was delivered from the valve to the gastric tube through a length of polyvinyl chloride tubing. The thick-walled and extremely flexible polyvinyl chloride tubing maintained a patent lumen despite considerable lateral rotation and twisting produced by the movement of the animal during the night. Chewing of this tube was discouraged by light counterweighting over

a small metal pulley suspended above the box and, for recalcitrant animals, by replacing the lower 4 to 5 inches with metal tubing. With the use of this tubing and automatic control and recording equipment, water intake under these unique conditions could be studied continuously, both day and night, for weeks at a time.

The gastric tube was made of a 2- and a 5-inch piece of stretched PE-90 polyethylene tubing joined by friction fit to the arms of a metal elbow made of a short length of No. 22 gauge hypodermic needle tubing bent to fit the shape of the snout. With the animal anesthetized with intraperitoneal injections of atropine (0.15 mg) and hexobarbital (13 to 15 mg/100 gm), the long arm of the gastric tube, stiffened by chilling in ice water, was carefully forced through the external naris and into the esophagus via the nasopharynx. The short arm of the tube was threaded under the skin of the snout and brought out through an incision between the animal's ears. The metal elbow was then embedded in the divided tissues of the superior border of the naris, thereby forcing the long arm of the gastric tube further down the esophagus and into the stomach. This final position was checked by indirect auscultation over the stomach during the injection of several cubic centimeters of air through the tube. The protruding short arm of the gastric tube, before being fixed to the skull with dental cement, was joined to a piece of No. 22 gauge needle tubing bent to project upward between the animal's ears. This thereafter served as the inlet to the stomach. The upper respiratory passages were kept clear by suction until the animal recovered from the anesthetic. Since this technique does not require abdominal surgery, abdominal infections were not encountered and the animals were usually eating and drinking normally the day after surgery.

Four normal rats and one rat suffering both moderate diabetes insipidus and hyperphagia, as a result of a single pair of hypothalamic lesions, were studied while they lived in open-topped wooden boxes (8 by 10 by 15 inches) with wire-mesh floors standing on urine collection pans. In order to familiarize them with the situation and with the necessity to press the bar to secure water, the animals were first trained to press the bar several times for each oral reward. When this behavior was well established, they were switched to direct intragastric self-injection. Purina chow pellets were available *ad libitum*, and the animals were weighed every day.

Figure 1 shows several typical days

Instructions for preparing reports. Begin the report with an abstract of from 45 to 55 words. The abstract should not repeat phrases employed in the title. It should work with the title to give the reader a summary of the results presented in the report proper.

Type manuscripts double-spaced and submit one ribbon copy and one carbon copy.

Limit the report proper to the equivalent of 1200 words. This space includes that occupied by illustrative material as well as by the references and notes.

Limit illustrative material to one 2-column figure (that is, a figure whose width equals two columns of text) or to one 2-column table or to two 1-column illustrations, which may consist of two figures or two tables or one of each.

For further details see "Suggestions to Contributors" [Science 125, 16 (1957)].

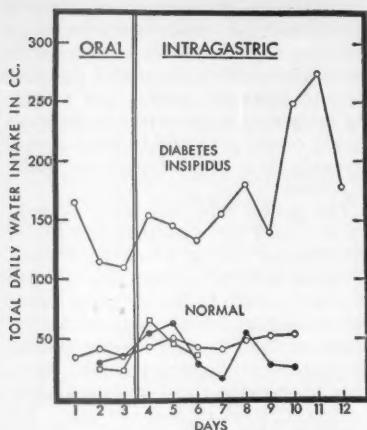


Fig. 1. Total daily intake of water obtained by three normal rats and a rat with diabetes insipidus during several typical days of bar pressing for oral intake and during a continuous period of bar pressing for direct intragastric injection.

of oral intake of water obtained by bar pressing and 3 to 9 nine days of direct intragastric water intake with each stomach load held within narrow limits for three normal rats and the diabetic rat. Note that total daily water intake remains within normal limits during the periods of direct intragastric self-injection. During these same periods the animals' weights remained essentially constant, and their average daily response totals were between 19.0 and 23.4 bar presses. In addition to demonstrating that the method described here can be used for long-term study of fluid intake, the relative constancy of these data show that preingestion factors are not necessary for the day-to-day regulation of water intake in the normal and the diabetic rat. This means not only that oropharyngeal sensations and feedback from consummatory responses are not essential here but also that this regulation can occur without the performance of the consummatory acts of licking and swallowing. Secondly, the data for the diabetic animal make it clear that the bar-pressing response used in the present method is sensitive to an increased need for water produced by a major alteration in the internal fluid balance.

The following additional facts support the view that bar pressing in this situation is related to the animal's need for water. First, the number of responses increases when the animal is required to press the bar several times for a single stomach load of constant size. A normal rat that had been pressing 20 to 25 times a day when every response was reinforced reached a peak of 74

responses when required to make five to six responses for a single stomach load. This adjustment required 2 or 3 days of experience with each of several successively higher ratios before normal regulation occurred. Second, the number of responses fell sharply in two well-trained animals (from 39 to 7, and from 46 to 9) when they were given *ad libitum* access to water by mouth with the bar in place but with the tube carrying water to the solenoid valve clamped shut. And in a third animal the solenoid valve was inadvertently disconnected overnight, depriving the animal of all water. In this case the number of responses rose from 55 during the previous day to 130 during the "deprivation" run. Thus the number of responses rises when water is more difficult or impossible to obtain and falls when it can be obtained freely by mouth.

The tendency toward excess intake that can be seen in Fig. 1 was dramatically revealed by progressively increasing the stomach load per injection between ranges of 0.75 and 42.0 ml for a normal rat and 0.9 and 63.3 ml for the diabetic rat over a period of several weeks. Despite a gradual fall in total daily responses, daily water intake rose rapidly from 30 ml/day to a plateau of 145 ml for the normal animal and from 200 ml/day to a plateau of 350 ml for the diabetic rat before falling off at the very high stomach loads. The normal as well as the diabetic animal produced large volumes of pale urine with the specific gravity of water during these periods of excessive intake. The loss of precise "metering" of water intake by feedback from licking and swallowing which has been suggested as an important role of preingestion factors may account for this phenomenon.

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6. N. E. Miller and M. L. Kessen [*ibid.* **45**, 550 (1952)], working with rats with chronic gastric fistulae, demonstrated that food injected into the stomach by the experimenter is a sufficient reinforcer for learning. This work suggested that the behavior required of the animal in the situation described here would be self-maintaining.
7. This work was done while I was a fellow of the National Foundation. I am grateful for the generous cooperation of Philip Teitelbaum in all phases of this research and to Elliot Stellar for his advice and criticism of the manuscript.

5 October 1959

Fatal Disease of Swine Due to Encephalomyocarditis Virus

Abstract. Encephalomyocarditis virus was isolated from the organs of swine dying during an outbreak of an acutely fatal disease occurring on a farm in Panama. The outstanding lesion was severe myocarditis. Pigs inoculated with the viral isolate developed a systemic infection with myocarditis.

During the past 20 years the encephalomyocarditis virus has been sporadically isolated from rodents and primates. It has been implicated as a cause of human disease. This report describes an outbreak of a fatal disease of swine due to the encephalomyocarditis virus. To our knowledge, the association of this virus with disease in domestic animals has not been previously recognized.

The outbreak occurred in July 1958 on a large commercial swine farm located 10 miles west of Panama City, Republic of Panama. Approximately 30 pigs died over a 20-day period in one overcrowded feed lot containing 300 3- to 5-month-old Duroc and Hampshire pigs. No deaths occurred in other pigs of the same age in an adjacent lot separated from the affected group by a narrow roadway.

The drove was frequently examined during the outbreak. The general appearance of the pigs was good. Some mild coughing and lameness were noted, which the owner did not consider unusual for his herd. All the pigs had been previously vaccinated for hog cholera. The feed ration consisted of corn with appropriate supplements.

Most deaths occurred at night; despite regular visits to the farm, the agonal stage was witnessed by only one of us, on a single occasion. The pig in question suddenly collapsed in severe dyspnea and died within a few minutes. The owner of the farm reported a similar observation.

Eight of the pigs that died during the outbreak were autopsied. Hydrothorax, hydropericardium, and ascites were frequently observed. The lungs were congested and edematous, with localized consolidation. The heart was soft and pale, with minute yellowish areas suggestive of necrosis. The meninges were slightly congested. Tissues for histopathological examination were selected from three animals which had died on the 6th, 10th, and 12th days, respectively, of the outbreak. The findings were severe myocarditis with round cell infiltration, vascular congestion, edema, and degeneration of the myocardial fibers; mild pneumonitis and pulmonary edema; mild meningitis and minimal congestion of the brain, with spotty areas of neuronal degeneration.

Bacteriological and virological studies were performed on two of these animals. Cultures of liver, spleen, brain, and blood were negative. Stained blood films were negative for blood protozoa.

An agent pathogenic for mice was repeatedly isolated from the lung and spleen of both of these pigs and from one of the brains. It was recovered from the brain, lung, and spleen of inoculated mice and passaged serially by the intracerebral, intraperitoneal, and intranasal routes. On initial passage in 2- and 21-day-old mice the average incubation period was 48 hours and 5 days, respectively. In later passages the incubation period in young adult mice was shortened. Usually adult mice presented flaccid posterior paralysis followed by coma and death, although some acute deaths with no paralysis occurred. Brains from moribund mice contained 10^6 to 10^8 mouse LD₅₀ doses. The virus was pathogenic for young hamsters and guinea pigs. It was reisolated and passaged in cell cultures of rhesus monkey kidney, hamster kidney, and HeLa cells. An agglutinin for sheep erythrocytes was demonstrated in infected mouse-brain tissue and in hamster-kidney culture fluid.

The agent was identified by neutralization tests in mice and tissue culture with a hyperimmune rabbit antiserum prepared against the American Type Culture prototype strain of encephalomyocarditis virus (1). The identification was confirmed at the Walter Reed Army Institute of Research (2). Viruses of the encephalomyocarditis group have never previously been isolated or studied in our Panama laboratories.

A pig, exhibiting fever, listlessness, and anorexia over a 48-hour period, developed a significant rise in neutralizing antibodies to the isolate. Neutralizing antibodies were found in the sera of rats (*Rattus rattus*) trapped on the farm in April 1959. Preliminary studies failed to demonstrate antibodies in the sera of ten men in contact with the swine at the time of the outbreak.

The disease was successfully reproduced by inoculation of two young pigs with the mouse-passaged virus. One pig was inoculated intercerebrally, the other, intraperitoneally. In both animals viremia was demonstrated on the 2nd day, and signs of disease appeared on the 3rd day. The pig inoculated intracerebrally developed progressive paralysis; it was bled and sacrificed on the 11th day. The neutralizing index of this serum was 60. Virus was not recovered from the organs tested. Severe myocarditis and moderate encephalitis were demonstrated histologically. The pig inoculated intraperitoneally became inappetent and listless and died on the 4th day after

inoculation. The virus was recovered from the lung and pooled liver-spleen specimens. Histologically severe myocarditis was found. The brain was not examined. The virus strains from both animals were reidentified.

To our knowledge, this report describes for the first time the natural infection of swine with the encephalomyocarditis virus and the most extensive outbreak of encephalomyocarditis infection in man or animals in which the virus was recovered. The outstanding lesion in these naturally infected animals was severe myocarditis. The evidence presented suggests that myocardial failure was the primary cause of death. Contamination of food and water with the excreta of infected rodents and swine possibly contributed to the spread of the virus in this outbreak.

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Notes

1. The encephalomyocarditis immune serum was supplied by William Pond of the National Institute of Allergy and Infectious Diseases.
2. We thank Malcolm S. Aronstein and Nancy Rogers of the Walter Reed Army Institute of Research for reidentifying the viral isolate.

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18 September 1959

Transport of Strontium-90 in Runoff

Abstract. Only a small portion of the strontium-90 that fell on cultivated soils was removed in runoff. The concentration of strontium-90 was usually about 10 times higher in the soil carried by the runoff than in the soil from the plow layer of the plots. Thus, a considerable concentration of Sr⁹⁰ could occur in areas where runoff sediments accumulate.

Strontium-90 is deposited on soil surfaces chiefly through rainfall (1). Thus it would seem to be especially likely to move in surface runoff. The extent of this movement was measured on plots which had previously been established for the study of soil losses by rainfall erosion.

Table 1. Strontium-90 in fallout and runoff from corn, oats, and clover plots at La Crosse, Wis., in 1957.

Period	Fall-out	Strontium-90 ($\mu\text{c}/\text{ft}^2$)		
		Runoff from plot		
		Corn	Oats	Clover
3/13-5/14	83	1.1	0.8	None
5/14-5/25	39	0.8	0.6	None
5/25-6/5	30	8.6	8.3	0.4
6/5-6/15	12	0.2	0.2	0.1
6/15-7/3	20	0.1	0.3	0.2
7/3-7/16	23	0.1	0.2	0.1
7/16-7/21	12	0.4	0.1	0.1
7/21-8/18	38	0.2	None	None
Total	257	11.5	10.5	0.9

Samples of runoff and rainfall were collected in 1957 at La Crosse, Wis., and Tifton, Ga. (2). The La Crosse plots are on Fayette silt loam with a 16-percent slope and are planted to corn, oats, and clover in rotation. The Tifton plots are on Tifton loamy sand with a 3-percent slope and are planted to corn, peanuts, and oats in rotation. One plot was sampled for each crop. The length of the plots was 72.5 ft at La Crosse and 83 ft at Tifton.

Rainfall and runoff samples were collected after each major runoff. The fallout of Sr⁹⁰ was collected by taking rainfall samples in washtubs 3 ft in diameter, which were left in the open near the plot areas at all times. A few quarts of dilute Sr(NO₃)₂ solution were kept in the tub to aid in dust retention and to act as a carrier. At La Crosse, the runoff was stirred and an aliquot was taken for analysis. At Tifton, the sediment was dried and mixed, and a sample was taken for analysis. The supernatant was discarded at Tifton because it had a negligible calcium content (3)—a finding which indicated that the supernatant would also contain negligible amounts of Sr⁹⁰ since strontium is adsorbed on soils more readily than calcium (4).

The Sr⁹⁰ content of the samples was determined at Beltsville, Md. The runoff samples were dried, and 0.1 mole of Sr(NO₃)₂ was added as carrier. Strontium-90 was extracted by overnight digestion with hot 4N HCl, filtration, and leaching with 1N HCl. Interfering radioactive elements were removed by scavenging precipitations; Y(OH)₃ was formed in the first of these precipitations, BaCrO₄ in the next two and Y(OH)₃ in the last. Strontium-90 was determined by separation and by following the decay of its yttrium-90 daughter. Rainfall samples were dried and analyzed by the same procedure, except that no further Sr(NO₃)₂ was added and the samples were only slightly acidified with HCl.

The rainfall was a little higher than average during the collection period at both locations. However, it was evenly distributed throughout the period, and there were few severe storms at critical cover periods. For these reasons, soil losses were lower than average. At La Crosse, something over 1 ton/acre was lost on the corn and oats plots and only 0.03 ton/acre on the clover plot. At Tifton, the soil losses were 0.3 ton/acre in plots planted to oats, 0.6 ton/acre in those planted to corn, and 0.7 ton/acre in those planted to peanuts.

The average fallout between runoff collections was 32 μC of Sr^{90} per square foot at La Crosse and 20 μC at Tifton. Usually about 1 percent of the fallout appeared in the runoff (Tables 1 and 2). The most notable exception was a runoff at La Crosse on 5 June, during which more than 8 μC of Sr^{90} per square foot, or more than 25 percent of the fallout, was carried off the plots of corn and oats. Strontium-90 radioactivity is given as of the date of each sample collection.

Only a small percentage of the Sr^{90} that fell on these soils was removed in runoff. The percentage removed was greater on plots with greater amounts of soil loss. Thus, the transport of Sr^{90} would probably increase with more erosive soils, steeper slopes, and cultivation systems which leave bare soil exposed for long periods. However, these conditions are at a minimum in most agricultural areas, and the Sr^{90} content of such soils will not be reduced appreciably by erosion.

Soil samples taken from the plow layer showed 45 μC of Sr^{90} per kilogram of soil at La Crosse on 11 April, and 16 μC at Tifton on 11 March, 1957. The concentrations of Sr^{90} were about ten times as high as these in the soil carried by the runoff from most of these plots. However, soil in the runoff from the clover plot at La Crosse, which

had the least amount of soil loss, showed 1300 μC of Sr^{90} per kilogram. Thus it appears that a considerable concentration of Sr^{90} can occur in the limited areas where runoff sediments accumulate.

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- 5 October 1959

Separation of Serum Antibody Activities by Anion-Exchange Cellulose Chromatography

Abstract. Mumps, *Histoplasma capsulatum*, thyroglobulin, and typhoid H antibodies were found in fraction 1, which contained only gamma globulins with ultracentrifugal sedimentation coefficients of 6.6 Svedberg units (S). Typhoid O antibodies and rheumatoid factor were only in fraction 5, composed principally of gamma macroglobulins with ultracentrifugal sedimentation coefficients of 18 S. In contrast isohemagglutinins, Rh antibodies, and anti-human liver nucleoprotein activities were found in two chromatogram fractions (1 and 5) with different physicochemical properties.

The gamma globulins in normal human serum are composed of two major groups of proteins. Ninety to 95 percent of the total gamma globulins have ultracentrifugal sedimentation coefficients of 6.6 S and 5 to 10 percent are 18-S gamma macroglobulins. The 6.6-S gamma globulins are known also to be a heterogeneous group of protein molecules with differing electrophoretic mobility and hexose content (1). Anion-exchange cellulose chromatographic techniques have been used to separate the 18-S gamma macroglobulins from most of the 6.6-S gamma globulins and also to subdivide the 6.6-S gamma globulins into four arbitrary fractions with distinctive physicochemical properties (1).

In view of this physicochemical evidence of gamma globulin heterogeneity and of the capacity of anion-exchange cellulose chromatography to fractionate the gamma globulins, a study of the distribution of normal and abnormal

physiologic activities among the chromatographic gamma globulin fractions was undertaken.

Sera containing antibodies to viral and bacterial antigens and antibody-like activity against human tissue or serum components were collected. Two or more sera were utilized for each activity tested except in the case of mumps, histoplasmosis, and rheumatoid arthritis sera (2).

Fractionation by zone (polyvinyl block) electrophoresis (1) of sera from each category except rheumatoid arthritis was performed. The activities in each instance were found among the gamma globulins. The gamma globulin fractions were then pooled, concentrated by ultrafiltration and chromatographed as described below.

Each whole serum (1.0 ml) and electrophoretically prepared gamma globulin (from 1.0 ml of sera) was chromatographed as described in detail elsewhere (1) on diethylaminoethyl (DEAE) cellulose (3) columns. Samples and columns were equilibrated with a starting buffer of 0.02M phosphate (pH 8) prior to sample application. Proteins were eluted from the column in 150 ml of effluent by a progressively increasing ionic strength gradient while pH 8 was maintained, and the protein distribution in the effluent fractions was determined by measurement of the optical density at 280 m μ . Subsequently the effluent was divided into 10 or more pools and, if necessary, the pools were concentrated to 1.0 ml by ultrafiltration and dialyzed thoroughly against pH 7.6 buffered saline prior to assay.

The distribution of the gamma globulins on chromatography of whole serum is illustrated in Fig. 1 (upper left corner). The distribution of electrophoretically prepared gamma globulin when chromatographed separately is the same. The physicochemical and immunochemical characteristics of gamma globulin fractions 1 to 5 have been described (1). Fraction 1 is the first protein peak and is obtained between 5 and 15 percent of the effluent volume. Fraction 2 is obtained between 15 and 25 percent, fraction 3 includes 25 to 45 percent, fraction 4 ranges from 45 to 58 percent, and fraction 5 from 58 to 80 percent.

The distribution of antibody activities after gamma globulin or whole serum chromatography is illustrated in Fig. 1. Antibodies to mumps virus and to *Histoplasma capsulatum* were found in fraction 1 which is composed of 6.6-S gamma globulins. Antibodies to thyroglobulin in the first three sera tested (4, 5) were also found in this fraction.

Table 2. Strontium-90 in fallout and runoff from corn, oats, and peanut plots at Tifton, Ga., in 1957.

Period	Strontium-90 ($\mu\text{C}/\text{ft}^2$)			
	Fallout	Runoff from plot		
		Corn	Oats	Peanuts
3/11-3/25	10	0.1	0.08	0.2
3/25-4/6	12	0.7	0.04	0.5
4/6-6/4	27	0.3	0.14	0.4
6/4-7/1	26	0.1	0.17	0.1
7/1-7/8	30	0.7	0.21	0.6
7/8-7/28	25	0.1	0.04	0.2
7/28-8/20	10	0.2	0.05	0.1
8/20-10/2	27	0.1	0.04	0.1
10/2-12/2	13	0.2	0.04	0.4
Total	180	2.5	0.81	2.6

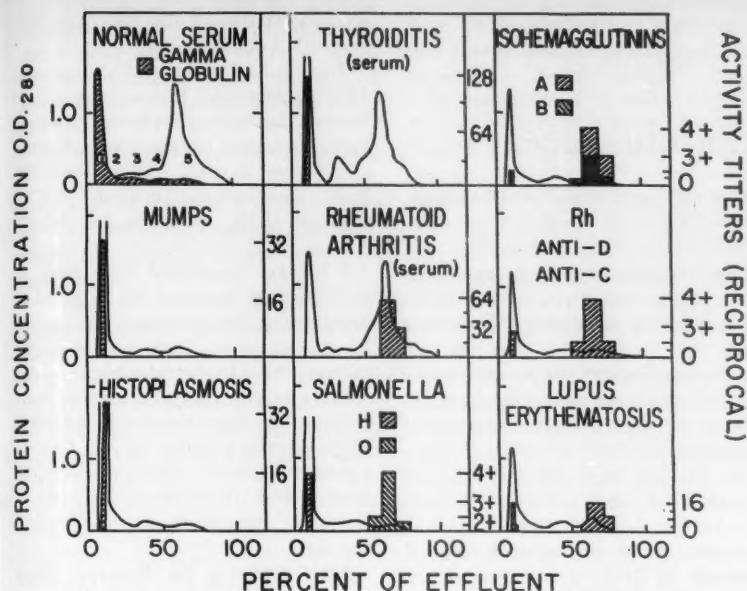


Fig. 1. Distribution of antibody activities after anion-exchange cellulose chromatographic fractionation of whole serum or of electrophoretically prepared gamma globulins. In the top left corner the gamma globulin distribution (shaded area) is illustrated in a normal chromatogram of whole serum.

The rheumatoid factor was found only in gamma globulin fraction 5, consistent with the location of the 18-S gamma macroglobulins in chromatogram fraction 5 and the gamma macroglobulin characteristics of the rheumatoid factor (6). Antibodies to the *Salmonella* (typhoid) O and H antigens were separated chromatographically. The antibodies to the H antigen were found in fraction 1 and the O antibodies were found in fraction 5, indicating different physicochemical properties for these two antibodies.

Fractions 2, 3, and 4 were not demonstrated to contain the major component of any physiologic activity as tested. These preliminary observations on fractions 2, 3 and 4, which together comprise about 20 percent of the total gamma globulin, do not reveal the functional role of these gamma globulins.

Several activities were found in both fractions 1 and 5. The anti-A and anti-B isohemagglutinins, the Rh antibodies, and the anti-liver-nucleoprotein extract activity, when present in the serum of patients with lupus erythematosus, were found in gamma globulin fractions 1 and 5. The finding of the same activity in both fraction 1 and fraction 5 indicated that the antibody activity was associated with distinctly different gamma globulin mole-

cules. The activities in fraction 1 could be assumed to be with 6.6-S gamma globulins, the only protein found in that fraction (1), and the activities in fraction 5 were likely to be 18-S gamma macroglobulins, which compose 90 percent of this gamma globulin fraction.

Ultracentrifugal studies have confirmed the physicochemical differences between the antibody activities in these two fractions. Isohemagglutinins (7) and anti-human-liver-nucleoprotein extract activity (5) in fraction 1 were found to sediment in the manner of 6.6-S gamma globulins and in fraction 5 to sediment as 18-S gamma macroglobulins.

The findings of two different gamma globulin fractions with apparently similar reactivity, however, does not necessarily indicate that the two types of proteins possess antibody activity at the same antigenic site. The materials used in the assay systems deserve close scrutiny. The red cell surface which determines isohemagglutinin and Rh factor reactions is well known to be antigenically complex, and the nucleoprotein extract used in testing for lupus erythematosus very likely contained many components. The question thus raised, whether gamma globulins, differing physicochemically enough to be separable from one another by chromato-

graphic procedures, can still react with identical antigen sites will have to await further study.

Anion exchange cellulose chromatography should prove to be a useful tool in immunologic investigations. A study of the chromatographic distribution of many of the activities in lupus erythematosus sera demonstrated that some factors capable of reactions with cell nuclear material could be chromatographically distinguished from factor(s) responsible for lupus erythematosus cell formation (8). The ability to separate two different gamma globulin molecules with apparently similar antibody activity will allow further study of these antibodies as well as of conditions favoring formation of the physicochemically distinct 6.6-S and 18-S antibodies (9).

JOHN L. FAHEY

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References and Notes

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2. Mumps virus and *Histoplasma capsulatum* antibody titers were measured in the sera of convalescents [American Public Health Association, *Diagnostic Procedures for Virus and Rickettsial Diseases* (New York, ed. 2, 1956), p. 241]. *Salmonella* O and H antibodies were investigated in sera from a typhoid carrier and an immunized subject [H. Welch and C. A. Stuart, *J. Lab. Clin. Med.* **21**, 411 (1936)]. Isohemagglutinins A and B in sera from two nonimmunized red blood cell group O donors and Rh⁺ (D) and rh' (C) antibodies in two high-titer sera were measured by agglutination techniques [P. J. Schmidt and H. Chaplin, Jr., *Am. J. Clin. Pathol.* **31**, 362 (1959)]. Rheumatoid arthritis serum factor was measured by the bentonite flocculation test [J. Bozicevich, J. J. Bunim, J. Freund, S. B. Ward, *Proc. Soc. Exptl. Biol. Med.* **97**, 180 (1958)]. Serum factors in lupus erythematosus were detected by employing human liver nucleoprotein extracts fixed to tanned red cells [H. C. Goodman and R. Bowser, *Federation Proc.* **17**, 56 (1958)]. Antithyroglobulin activity was similarly determined in Hashimoto's disease sera [E. Witebsky, N. R. Rose, K. Terplan, J. R. Paine, R. W. Egar, *J. Am. Med. Assoc.* **164**, 1439 (1957)].
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8. H. C. Goodman, J. L. Fahey, R. A. Malmgren, G. Brecher, *Lancet* **2**, 382 (1959).
9. I am greatly indebted to the following individuals who generously made available sera or quantitative measurements, or both, essential to this work: Dr. H. C. Goodman, antithyroglobulin and antinucleoprotein activities; Dr. P. J. Schmidt and Mrs. E. G. Morrison, isohemagglutinins and Rh antibodies; Dr. J. P. Utz and Mr. C. J. Szwed, mumps and *Histoplasma capsulatum* antibody titers; Dr. K. J. Block, rheumatoid factor; and Dr. H. H. Marsh, measurements of *Salmonella* antibodies.

11 August 1959

Thomas Park, President-Elect

There are several things that the Council of the American Association for the Advancement of Science must keep in mind in electing a president. He should be a man who has made contributions to his field of science that command the respect of the scientific community. He should have administrative ability. He should have had experience with the problems of the organization of science, problems that are rapidly approaching the crisis stage in this country. His field should be an important one, but different from the fields of his immediate predecessors in order that a proper balance in the activities of the Association may be maintained.

The man whom the Council has chosen as president-elect for 1960, Thomas Park, professor of zoology at the University of Chicago, meets all these qualifications. He will succeed a pharmacologist whose predecessors were a physicist and an organic chemist. He himself is an animal ecologist and, in particular, one concerned with the dynamics of populations.

While his work has been concerned with beetles, it has had very important implications for human beings. It bears, indeed, on the question of the very persistence of mankind, or at least of civilized man, in the explosive situation brought about by the world-wide decrease in mortality rates and the lack of compensating decreases in birth rates. The alternatives are violent reduction or even extinction of the human species, perhaps by way of the hydrogen bomb; expansion to a violently fluctuating upper limit, controlled by the availability of necessities for bare subsistence; or attainment of ecologic equilibrium with the resources of the world at such a level that progress in civilization remains possible. Park brings a keen awareness of the population problem to the thinking of organized science.

Park has been a member of the Board of Directors of the American Association for the Advancement of Science since 1954. He has served as chairman

of the Publications Committee since 1955, and he served as a member of the Newcomb Cleveland Prize Committee from 1956 to 1958. He thus has firsthand familiarity with the potentialities of the Association for promoting the development of science for the welfare of this country.

He has also been active in affiliated societies and other scientific organizations in his field of interest. He was president of the Ecological Society of America in 1959, a member of the policy committee of the American Society of Zoologists in 1957-58, and a member of the Environmental Biology Panel of the National Science Foundation. He has served as editor of *Ecology* (1940-50), as editor of *Physiological Zoology* (1955-), and as a member of the editorial boards of the *Quarterly Review of Biology* (1938-) and the *American Naturalist* (1951-59). He has been zoological adviser to the *Encyclopaedia Britannica* since 1950. Moreover, he brings to American science experience as a Rockefeller Foundation fellow at Oxford University (1948), where he worked with Charles Elton; this was fol-



Thomas Park

lowed by a four-month appointment as scientific attaché of the American Embassy in London.

Thomas Park was born 17 November, 1908 in Danville, Illinois, the son of Samuel Thomas and Sophronia (Stealey) Park. He graduated from the University of Chicago in 1930 and received his Ph.D., also from the University of Chicago, in 1932, under the late W. C. Allee.

I became acquainted with Park in 1927 when he attracted my attention as being among the 10 percent who earned A's in each of two large undergraduate courses that I was conducting. His promise as an undergraduate was fully borne out by his performance in two of my courses in genetics that he took as a graduate student, while specializing in another field. It has been borne out in increasing measure by his career since that time.

After receiving his doctorate, Park spent several years at Johns Hopkins, where, as a national research fellow, instructor, and associate, he came under the stimulating influence of the late Raymond Pearl. He there continued the intensive study of the dynamics of populations that he has made his life work. He was called back to the University of Chicago in 1937 as instructor and rose through the various grades to the professorship (1947) that he still holds.

In his research program, he has used two species of flour beetles, *Tribolium confusum* and *T. castaneum*, animals that have an unusual combination of favorable characteristics for the analysis of population dynamics. It is safe to say that, as a result of his efforts and those of a large group of enthusiastic graduate and postgraduate students, and, recently, the cooperation of Jerzy Neyman and his co-workers at the University of California, there is no other animal in which the analysis of population dynamics has been carried so far.

Each of the above species reaches a fluctuating equilibrium in numbers which can be maintained for years under specified conditions. The results of competition have been especially instructive. In any given mixed population, one or the other species always becomes extinct. Under certain conditions, one species wins out 100 percent, but this is not necessarily the one that does best by itself under the same conditions. Under other specifiable conditions, the result is indeterminate. Each species wins out in a characteristic percentage

of the cases; again, there is no direct relationship to the degree of success of that species when it is alone. The interpretation requires the introduction of stochastic as well as deterministic processes.

As by-products of these researches, Park has found a number of Mendelian mutations of *Tribolium* species which present interesting material for joint studies in population dynamics and genetics.

Park and his students have published numerous papers dealing with their researches. In addition, he is coauthor with the late W. C. Allee and with Alfred Emerson, both of the University of Chicago, with the late Karl P. Schmidt of the Chicago Natural History

Museum, and with his brother, Orlando Park of Northwestern University, of the comprehensive and widely used *Principles of Animal Ecology*.

He was married in 1928 to Martha Alden Whitehead. Their daughters, Sherley Louise and Judith, are both married, and the Parks have several grandchildren. Many of us, faculty and students, who have left the University of Chicago, have a rich store of happy memories of the hospitality of Tom and Martha Park.

As I have mentioned, Park has served in important administrative positions. My own direct observations of his ability along this line have been restricted to observations of his performance in such administrative positions at

the University of Chicago as secretary of the zoology department during a difficult period and as associate dean of the division of biological sciences from 1943 to 1947. I have been impressed by two characteristics that do not always go together. One is the meticulously systematic way in which he breaks down his problems and organizes his work. The other is his concern for people. Tom Park likes people and likes to help them in their problems, and he does so very effectively. The American Association for the Advancement of Science is to be congratulated on the prospect of his leadership in 1961.

SEWALL WRIGHT

Department of Genetics,
University of Wisconsin, Madison

AAAS Council Meeting, 1959

Dael Wolfe

Affiliates

Upon recommendation by the Committee on Affiliation and with the concurrence of the Board of Directors, the Council elected the following organizations as affiliates of the Association: Academy of Psychoanalysis, American Speech and Hearing Association, Association of Clinical Scientists, Medical Correctional Association, New Jersey Academy of Science, and Society for the History of Technology. These elections bring the number of organizations affiliated with the AAAS to 291.

Metric Usage

Wilmer Souder, chairman of the Committee on Metric Usage, presented the following report on behalf of the committee (other members are John T. Johnson, Robert J. Painter, William G. Pollard, Henry D. Sharpe, Jr., and C. A. Whitten).

"1. The primary task assigned to the Special Committee at the 1958 meeting is to study the report of the British Association and bring a recommendation to the 1959 meeting of the AAAS. The expected report has not been received. Consequently, no study could be made. (See recommendation 3 below.)

"2. Recent private correspondence indicates that the British Committee is unlikely to recommend compulsory adoption of the metric system by the United Kingdom now or in the near future.

The AAAS Council held two sessions during the annual meeting of the Association in Chicago, 26 to 31 December. Both sessions were under the chairmanship of President Paul E. Klopsteg, and both were held at the Morrison Hotel. One hundred and seventeen members attended the first session, at 4:00 P.M. on 27 December, and 134 the second session, at 9:00 A.M. on 30 December.

Elections and Officers

The President announced that Council, by mail ballot, had elected Thomas Park as president-elect and Harrison Brown and Alfred Romer as members of the Board of Directors. The vacancy on the Board created by the election of Park as president-elect was filled by the Board by the selection of Don K. Price.

The vice presidents and chairmen

of sections, as elected by the Council, are listed on pages 506 to 510. The Executive Officer reported that the Board of Directors had reelected Herbert A. Smith of the U.S. Office of Education as Secretary of Section Q-Education and had elected Stanley S. Ballard of the University of Florida as Secretary of Section B-Physics, Harriet B. Creighton of Wellesley College as Secretary of Section G-Botany, and Frank W. Finger of the University of Virginia as Secretary of Section I-Psychology. All four were elected for 4-year terms, 1960 through 1963.

Election of Council members to serve on the Committee on Nominations was postponed, and the President was requested to name an *ad hoc* committee to select a slate of names to be submitted to the Council for vote by mail. The President subsequently named A. C. Smith, Conrad Taeuber, and William A. Wildhack to serve as the *ad hoc* committee.

"We therefore recommend that the American Association for the Advancement of Science hold in abeyance any formal activities on that part of the 1957 resolution wherein: 'It tenders its cooperation to the British Association in any practicable efforts to further this objective' (general adoption of the metric system of weights and measures).

"3. Two bills have been introduced in the 86th Congress, 1st Session, wherein it is proposed that a study and a program be conducted to determine the practicability and desirability of the adoption by the United States of the metric system of weights and measures. (S. 2420 directs the Secretary of Commerce to conduct the study. H.R. 7401 directs the National Bureau of Standards to conduct the program.)

"If these bills are reported out for hearings, we recommend that the American Association for the Advancement of Science proffer the assistance of its specialists in their respective fields of competence wherein discussions relating to the 'Advancement of Science are pertinent.'

"4. We respectfully request that the Special Committee be discharged."

Council voted to adopt the report and to discharge the committee with thanks.

Upon motion made from the floor, Council voted to adopt the following resolution relative to the metric system:

"WHEREAS, Action is now pending before the Congress relative to a study of the metric system; and

"WHEREAS, The report of the recent AAAS Committee on Metric Usage included the recommendation that specialists of the AAAS be made available for the constructive study of the metric system,

"Be it therefore resolved by the Council of the AAAS, That the officers and Board of Directors of the AAAS be urged to organize such specialists in the most effective way."

Council Activities and Organization

The major item of business on the Council agenda was consideration of the report prepared by the Committee on Council Activities and Organization [William A. Wildhack (chairman), Allan D. Bass, Ward Pigman, Albert E. Sobel, Leon Sokoloff, and Paul E. Klopsteg ex officio]. The report had been circulated in advance to all Council

members and has been distributed in revised form to Council members since the meeting. The committee report included a number of major recommendations:

1) The codification of rules of Council procedure and the adoption of certain new rules.

2) The establishment of three standing committees of the Council—a Committee on Council Activities and Organization, a Committee on Nominations and Elections (continuing the present Committee on Nominations), and a Committee on Constitution and Rules.

3) The establishment of a number of special committees to study, review, or prepare recommendations or findings on any specific problem, issue, or policy in which Council considers that such committee activity would be beneficial to the Association.

4) The provision of advisory committees or panels to each of a number of the Association's committees. These advisory committees would work by correspondence only and would provide each member of Council with an opportunity to serve as an adviser to one or more of the Association's committees.

The committee report concluded with a list of major organizational matters on which Association policy should be reviewed and which were recommended for consideration during 1960 by the proposed Committee on Council Activities and Organization.

Extended and vigorous debate dealt primarily with two issues: (i) the extent to which the proposed standing Committee on Council Activities and Organization would overlap in authority and responsibility the Board of Directors, and (ii) the extent to which the proposed special committees would overlap in function some of the already existing committees.

Advocates of the proposed standing Committee on Council Activities and Organization contended that since the committee would deal only with matters of direct concern to the Council and would not become involved in policy concerning the Association's financial affairs, publication program, meetings, or other activities, there would be no overlap in authority or responsibility between the committee and the Board of Directors. Opponents of the proposed new committee took the position that matters of policy could not be so divided and that the pro-

posed committee, which would in some respects serve as an executive committee of the Council, would inevitably overlap in authority and responsibility the Board of Directors, which also serves as executive committee of the Council.

The debate on the special studies committees centered on the extent to which they would overlap functions of such existing committees as the Committee on Cooperation among Scientists, the Committee on Public Understanding of Science, and the Committee on Science in the Promotion of Human Welfare, which had been established by Council vote a year earlier.

After a number of trial motions, including a motion to approve the committee report as a whole, Council voted that it was the sense of Council that the entire report be approved except for the provisions for the establishment on a permanent basis of a Committee on Council Activities and Organization. It was explained that "the sense of Council" means that Council approves the objectives of the committee report but that discrepancies between the report and the Association's Constitution and Bylaws would have to be worked out and that a number of modifications in the report would be made necessary by the decision not to approve a permanent Committee on Council Activities and Organization. It was agreed that these matters would be cleared up during the coming year. Council then voted to continue the temporary Committee on Council Activities and Organization for one year, with the presumption that the committee would work with the Board of Directors in making the necessary changes in the committee report and in removing the points of disagreement between the committee report and the Association's Constitution and Bylaws. How these matters are to be resolved will be reported to Council prior to the 1960 annual meeting.

Resolutions

The Committee on Council Agenda and Resolutions [Paul S. Dwyer (chairman), Robert C. Miller, George C. Paffenbarger, and Kenneth C. Spengler] submitted the following resolutions, all of which were approved by Council vote.

Resolution on national research and education program in over-all health area. "The Council of the AAAS com-

AAAS Operating Fund Budget, 1960:
Receipts

Item	Estimated receipts
Dues of annual members	\$ 465,000
Journal subscriptions for emeritus members	9,100
Nonmember subscriptions	80,000
Back issues and proof	3,500
Advertising	480,000
Sale of:	
Microcards	700
Binders	2,300
Symposium volumes	70,000
Emblems	2,200
Directories	250
Meeting and exposition	41,800
Rental receipts	16,250
Income from investments	18,000
Cash discounts	600
Administration of projects	39,500
Other receipts	2,000
Total receipts	\$1,231,200

mends the Department of Health, Education, and Welfare for its foresight in obtaining outstanding consultants to report on the complex questions involved in the future of our national research and education program in the over-all health area. Further, the Council recommends the appointment of a committee to consider the need of a permanent national council for the advancement of research and education in the over-all health area with special emphasis on basic research and the training of research personnel."

Resolution on preparation of books and pamphlets. "It is recommended that the Council of the AAAS request the Committee on Science in the Promotion of Human Welfare to study the feasibility of undertaking, sponsoring, or promoting the publication of books and pamphlets suitable for wide public dissemination summarizing the scientific facts, the public interest and the public issues involved in areas where the public understanding of the scientific facts may have important consequences and in which suitable books and pamphlets are not and will not be otherwise available."

Resolution on continuity of research support. "The Council of AAAS favors institutional support of research by the Federal Government as the Council realizes the necessity of more continuity in research support."

Resolution on international communication. "It is recommended that the Council authorize a committee study on international scientific communication. The purpose of this study shall be to suggest methods of improving the current situation."

Resolutions dealing with wildlife conservation. "One resolution relating to the effects of poisons on fish and wildlife resources and one on the establishment of a National Wildlife Disease Institute were submitted by C. R. Gutermuth, vice-president of the Wildlife Management Institute. These resolutions deal with AAAS support of pending legislation. The Council Agenda and Resolutions Committee recommends that these resolutions be referred to an appropriate committee."

Resolution on elimination of the affidavit required by Section 1001 (f) of the National Defense Education Act. "WHEREAS, The general objective of the National Defense Education Act is the security and welfare of the nation and the strengthening of both through support of higher education; and

"WHEREAS, The requirement of the so-called disclaimer affidavit of this act: (a) discriminates against students receiving federal loans by requiring each to make an affidavit which is not required of other recipients of federal loans or of other beneficiaries of federal funds, (b) may be indefinite and uncertain in its legal application since the signer does not know which organizations may be legally classed as subversive, (c) is not generally effective in discovering disloyalty and in promoting loyalty,

"Therefore, The Council of the American Association for the Advancement of Science believes that the national welfare, education and science, will be furthered by the deletion of the affidavit requirement from Section 1001 (f) of the National Defense Education Act."

Resolution on criteria for tax-exempt organizations. "A resolution has been received calling attention to the difficulty of interpreting the phrase 'substantial part' in the law relating to legislative activities of tax-exempt organizations. It is recommended that this resolution be referred to the Board of Directors."

On motion made from the floor, Council adopted the following resolution, as a substitute for one proposed by the Committee on Council Agenda and Resolutions but defeated by Council vote:

"As a result of numerous recent developments in international relationships, the Council of the AAAS hereby affirms the urgent desirability of continued efforts through the United Nations and continued negotiations among

governments toward adoption of plans leading to the peace of the world."

Council voted a resolution of thanks to the Committee on Council Agenda and Resolutions for its handling of a number of difficult and controversial items.

Finances

The Executive Officer reported that a preliminary summary of 1959 receipts and expenditures indicated a balance of approximately \$75,000 in the Association accounts for the year. Normal operating receipts for the year amounted to approximately \$1,175,000. In addition, the Association received grants for special purposes totaling \$943,000. The total of \$2,120,000 is approximately \$600,000 greater than

AAAS Operating Fund Budget, 1960:
Expenses

Item	Estimated expenses
Administrative Expenses	
Salaries	\$ 225,500
Insurance, retirement, and social security	22,550
Building maintenance	48,200
Interest on mortgage	5,125
Office supplies	28,900
Telephone and telegraph	3,150
Postage and freight	16,000
Travel	3,000
Executive Officer's discretionary fund	5,000
Miscellaneous	20,200
	\$ 377,625
Printing and manufacturing	
Science Symposium volumes	\$ 500,000
Binders	46,000
Microcards	1,400
Emblems	600
	1,200
	\$ 549,200
Annual Meeting	
Meeting and exposition	\$ 21,100
Press service	8,000
Academy Conference and General Symposium	2,000
	\$ 31,100
Sections, divisions, boards, and committees	
Section expenses	\$ 5,000
Division allowances	9,300
Board of Directors	7,000
Editorial Board	7,500
Other committees	10,000
	\$ 38,800
Advertising, cost of selling	\$ 124,000
Contingencies and new activities	\$ 10,000
Non-cash items	
Depreciation of building	\$ 23,519
Depreciation of equipment	10,000
	\$ 33,519
Total operating expenses	\$1,164,244
Net receipts	\$ 66,956

the amount in 1958 and well over three times the amount for 1954. As measured in dollars, the Association's scale of operations has more than tripled in five years.

Of the \$943,000 in grants, \$600,000 came from the National Science Foundation to support the Traveling Libraries of Science Books. One hundred thousand dollars of this amount was in completion of a grant for the 1958-59 program, and \$500,000 represented the total grant for the 1959-60 program. The Traveling Science Libraries are now going to 1700 high schools and 800 elementary schools in the United States. In terms of numbers of schools, this program has now reached its maximum planned size. The program will be continued at this level for the next several years, but because it will no longer be necessary to purchase large numbers of books, the amount of money required will be smaller, approximately \$250,000 a year.

A grant of \$7500 from the Asia Foundation has made it possible to prepare a number of sets of science books for distribution to school libraries in Southeast Asia.

Three grants were received during the year for work in the field of science education. From the Carnegie Corpo-

ration came \$83,000 (the second annual payment on a 3-year grant of \$250,000) to support the Association's Science Teaching Improvement Program. Another grant from the Carnegie Corporation of \$81,000 was made to the Association to support the work of the National Association of State Directors of Teacher Education and Certification in their effort to develop better and more standardized requirements for the certification of teachers of high-school science and mathematics [see *Science* **130**, 1237 (6 Nov. 1959)].

From the National Science Foundation the Association received \$38,620 as reimbursement for the costs of administering a program of selecting high-school science and mathematics teachers who were granted fellowships for graduate study during summer sessions.

The Association received \$7500 from the Westinghouse Educational Foundation to provide for two annual awards of \$1000 each, and the cost of administering these awards, for excellence of science writing in newspapers and magazines.

The major portion of the expense for the Symposium on Basic Research held in New York 14-16 May and jointly sponsored by the National Acad-

emy of Sciences, the Alfred P. Sloan Foundation, and the AAAS was paid by the Sloan Foundation. The Association, however, received the sum of \$8547 in reimbursement for expenses of publishing the symposium volume, *Symposium on Basic Research*.

The first International Oceanographic Congress, arranged by the AAAS with the cosponsorship of UNESCO and the Special Committee on Oceanic Research of the International Council of Scientific Unions and held in New York City from 30 August to 11 September, received gifts, grants, or contracts totaling \$117,000 from UNESCO, the Office of Naval Research, the National Science Foundation, the Atomic Energy Commission, the Rockefeller and Sloan foundations, and a number of industrial organizations.

This generous support from a variety of sources has enabled the AAAS to extend its efforts toward the advancement of science and the improvement of science education far beyond the limits set by its own funds.

On behalf of the Treasurer, the Executive Officer presented the budget that the Board of Directors had adopted for 1960. The budget is shown in the accompanying tables.

AAAS Officers, Committees, and Representatives for 1960

The following persons are serving as officers, as members of the indicated committees, and as representatives to other organizations for the year 1960. The dates in parentheses indicate the year of expiration of terms of election or appointment.

General Officers

Retiring President and Chairman of the Board of Directors: Paul E. Klopsteg (1960), 828 Apple Tree Lane, Glenview, Ill.

President: Chauncey D. Leake (1961), Ohio State University

President-Elect: Thomas Park (1962), University of Chicago

Other Members of the Board of Directors

Don K. Price (1960), Harvard University

Mina S. Rees (1960), Hunter College

Alan T. Waterman (1960), National Science Foundation

William W. Rubey (1961), U.S. Geological Survey

H. Bentley Glass (1962), Johns Hopkins University

Margaret Mead (1962), American Museum of Natural History

Harrison Brown (1963), California Institute of Technology

Alfred S. Romer (1963), Harvard University

Paul A. Scherer (ex officio), Research Corporation

Dael Wolfe (ex officio), AAAS

Vice Presidents and Chairmen of the Sections

A Mathematics: William L. Duren, Jr., University of Virginia

B Physics: John H. Van Vleck, Harvard University

C Chemistry: Robert W. Schiessler, Socony Mobil Oil Company, Paulsboro, N.J.

D Astronomy: Nicholas U. Mayall, Lick Observatory, Mt. Hamilton, Calif.

E Geology and Geography: William C. Krumbein, Northwestern University

F Zoological Sciences: Viktor Hamburger, Washington University

G Botanical Sciences: Barry Commoner, Washington University

H Anthropology: Cornelius Osgood, Yale University

I Psychology: Clifford T. Morgan, University of Wisconsin

K Social and Economic Sciences: Pendleton Herring, Social Science Research Council

L History and Philosophy of Science: Harry Woolf, University of Washington

M Engineering: Clarence E. Davies, United Engineering Center Project, New York

N Medical Sciences: Carl F. Schmidt, University of Pennsylvania School of Medicine

Nd Dentistry: Joseph L. T. Appleton, University of Pennsylvania School of Dentistry

Np Pharmacy: Joseph V. Swintosky, Smith, Kline and French Laboratories

O Agriculture: Firman E. Bear, Rutgers University

P Industrial Science: J. A. Hutcheson, Western Electric Corporation, Pittsburgh, Pa.

Q Education: John C. Flanagan, American Institute for Research, Pittsburgh, Pa.

Administrative Officers

Executive Officer: Dael Wolfe

Treasurer: Paul A. Scherer

Associate Administrative Secretary: Raymond L. Taylor

Editor: Graham DuShane

Business Manager: Hans Nussbaum

Director of Education: John R. Mayor

Director, Science Library Program: Hilary J. Deason

Secretaries of the Sections

A Mathematics: C. C. MacDuffee (1960), University of Wisconsin

B Physics: Stanley S. Ballard (1963), University of Florida

C Chemistry: Edward F. Degering (1960), 26 Robinhood Road, Natick, Mass.

D Astronomy: Frank B. Wood (1961), University of Pennsylvania

E Geology and Geography: Frank C. Whitmore, Jr. (1960), U.S. Geological Survey

F Zoological Sciences: Karl M. Wilbur (1961), Duke University

G Botanical Sciences: Harriet B. Creighton (1963), Wellesley College

H Anthropology: James L. Giddings (1961), Brown University

I Psychology: Frank W. Finger (1963), University of Virginia

K Social and Economic Sciences: Donald P. Ray (1962), George Washington University



Harrison Brown is a new member of the AAAS Board of Directors.

L History and Philosophy of Science: John W. Streeter (1961), Chester Springs, Pa.

M Engineering: E. Paul Lange (1960), Engineers Joint Council, New York, N.Y.

N Medical Sciences: Allan D. Bass (1960), Vanderbilt University School of Medicine

Nd Dentistry: Reidar F. Sognaes (1962), Harvard School of Dental Medicine, Boston

Np Pharmacy: John E. Christian (1962), Purdue University School of Pharmacy

O Agriculture: Howard B. Sprague



Alfred S. Romer is a new member of the AAAS Board of Directors.

(1961), Pennsylvania State University
P Industrial Science: Allen T. Bonnell (1960), Drexel Institute of Technology

Q Education: Herbert A. Smith (1963), U.S. Office of Education

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Vice President: Calvin J. Lensink, Alaska Department of Fish and Game, Juneau

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Executive Secretary: Albert W. Johnson, University of Alaska, College

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Officers of the Pacific Division

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Konrad B. Krauskopf (1963), Stanford University

Edwin M. Lerner (1964), National Institutes of Health

H. Burr Steinbach (1963), University of Chicago

William L. Straus, Jr. (1963), Johns Hopkins Medical School

Edward L. Tatum (1962), Rockefeller Institute

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Wayne Taylor, Michigan State University, vice-chairman

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Bruce E. Meserve, Montclair State College

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Leonard O. Olsen, Case Institute of Technology

Thornton L. Page, Wesleyan University

W. E. Restemeyer, University of Cincinnati

Richard L. Weaver, University of Michigan

Harold E. Wise, University of Nebraska

Theodore Woodward, Department of Agriculture, Washington, D.C.

Dael Wolfe, AAAS, ex officio

AAAS Meetings

Allen T. Bonnell (1962), Drexel Institute of Technology, chairman

Ellis A. Johnson (1960), Johns Hopkins University

William C. Steere (1961), New York Botanical Garden

Stanley A. Cain (1962), University of Michigan

Frank Fremont-Smith (1962), Josiah Macy, Jr. Foundation

Ralph R. Shaw (1962), Rutgers University

John R. Bowman, Northwestern University, ex officio

Barry Commoner, Washington University, ex officio

Warren Weaver, Alfred P. Sloan Foundation, ex officio

Dael Wolfe, AAAS, ex officio

Raymond L. Taylor, AAAS, staff representative

Affiliation

I. Melville Stein (1962), Leeds and Northrup Company, Philadelphia, chairman

Luna B. Leopold (1960), U.S. Geological Survey

Earl L. Green (1961), Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me.

Paul B. Sears (1963), Yale University

Rensis Likert (1964), University of Michigan

Dael Wolfe, AAAS, ex officio

Raymond L. Taylor, AAAS, staff representative

Cooperation among Scientists

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Burton W. Adkinson, National Science Foundation

Richard T. Arnold, Alfred P. Sloan Foundation

R. E. Gibson, Applied Physics Laboratory, Johns Hopkins University

Thomas Parran, Avalon Foundation, New York, N.Y.

H. Bentley Glass, ex officio Board representative

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Thomas Park

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J. E. Graf (1960), Smithsonian Institution

Sheldon B. Akers (1961), Brookings Institution, vice chairman

Malvern F. Morse (1963), American Security and Trust Company

Wallace R. Brode (1964), Department of State

Paul A. Scherer, Research Corporation, ex officio

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Hans Nussbaum, AAAS, staff representative

Nominations and Elections

Paul E. Klopsteg (1960), 828 Apple Tree Lane, Glenview, Ill., chairman

H. Trendley Dean (1960), 2006 Cleveland St., Evanston, Ill.

Harold D. Lasswell (1960), Yale University

Thomas Park (1961), University of Chicago

(Note: Three additional members are to be elected by Council, by means of mail vote.)

Public Understanding of Science

Warren Weaver, Alfred P. Sloan Foundation, chairman

Willard Bascom, National Academy of Sciences

Allen T. Bonnell, Drexel Institute of Technology

Victor Cohn, *Minneapolis Star and Tribune*

Paul E. Klopsteg, 828 Apple Tree Lane, Glenview, Ill., ex officio Board representative

Dael Wolfe, AAAS, ex officio

Publications

Thomas Park (1962), University of Chicago, chairman

George R. Harrison (1960), Massachusetts Institute of Technology

H. Bentley Glass (1961), Johns Hopkins University

Ralph R. Shaw (1963), Rutgers University

Chauncey D. Leake (1964), Ohio State University

Dael Wolfe, AAAS, ex officio

Graham DuShane, AAAS staff representative

Science in the Promotion of Human Welfare

Barry Commoner (1962), Washington University, chairman

Robert B. Brode (1960), University of California, Berkeley

Lawrence K. Frank (1960), 25 Clark Street, Belmont, Mass.

Harrison Brown (1961), California Institute of Technology

Frank W. Notestein (1961), Population Council, Inc., New York, N.Y.

T. C. Byerly (1962), Agricultural Research Service, Department of Agriculture, Washington, D.C.

H. Jack Geiger (1962), Harvard Medical School, Boston

Margaret Mead, American Museum of Natural History, ex officio Board representative

Dael Wolfe, AAAS, ex officio

Special Committees

AAAS—Anne Frankel Rosenthal Memorial Award for Cancer Research, Judges

Lowell T. Coggeshall, University of Chicago, chairman

Harry S. N. Greene (American Association for Cancer Research), Yale University School of Medicine

G. Burroughs Mider, National Cancer Institute

Richard L. Rosenthal, Richard and Hinda Rosenthal Foundation

C. Chester Stock, Sloan-Kettering Institute for Cancer Research

Harry M. Weaver, American Cancer Society

AAAS—Campbell Award for Vegetable Research, Judges

Louis P. Reitz (AAAS Section O—Agriculture), Agricultural Research Service, Beltsville, Md., chairman

Sterling B. Hendricks (American Society of Plant Physiologists), Plant Industry Station, Beltsville, Md.

Iver J. Johnson (American Society of Agronomy), Iowa State College

F. F. Smith (Entomological Society of America), U.S. Department of Agriculture, Entomology Research Branch, Beltsville, Md.

F. C. Stark, Jr. (American Society for Horticultural Science), University of Maryland

G. Ledyard Stebbins, Jr. (Genetics Society of America), University of California, Davis

E. E. Wilson (American Phytopathological Society), University of California, Davis

AAAS—Ida B. Gould Memorial Award for Research on Cardiovascular Problems, Judges

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Robert P. Glover (American College of Cardiology), Presbyterian Hospital, Philadelphia

Dickinson W. Richards (Life Insurance Medical Research Fund), Bellevue Hospital, New York

Richard L. Rosenthal, Richard and Hinda Rosenthal Foundation

Francis C. Wood (American Heart Association), University of Pennsylvania Hospital

J. Franklin Yeager, National Heart Institute

AAAS Newcomb Cleveland Prize, Judges

Thomas Park, University of Chicago, chairman

Wallace R. Brode, Department of State

Alfred E. Emerson, University of Chicago

M. R. Irwin, University of Wisconsin
Chauncey D. Leake, Ohio State University

Clifford T. Morgan, University of Wisconsin

William W. Rubey, U.S. Geological Survey

Paul B. Sears, Yale University

A. C. Smith, U.S. National Museum

Howard B. Sprague, Pennsylvania State University

AAAS Socio-Psychological Prize

Pendleton Herring, Social Science Research Council

Donald P. Ray, George Washington University

Dael Wolfe, AAAS

AAAS—Westinghouse Science Writing Awards, Managing Committee

Graham DuShane, AAAS, administrator

Jules B. Billard, *National Geographic Magazine*

Charles N. Fry, Westinghouse Electric Corporation

Harry R. Gail, Westinghouse Electric Corporation

Nate Haseltine, *Washington Post and Times Herald*

Hans Nussbaum, AAAS

Dael Wolfe, AAAS

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William A. Wildhack, National Bureau of Standards, chairman

Allan D. Bass, Vanderbilt University School of Medicine

Ward Pigman, University of Alabama Medical Center

Albert E. Sobel, Jewish Hospital of Brooklyn

Leon Sokoloff, National Institutes of Health

Paul E. Klopsteg, Glenview, Ill., ex officio

Council Agenda and Resolutions

Paul S. Dwyer, University of Michigan, chairman

Robert C. Miller, California Academy of Sciences

George C. Paffenbarger, National Bureau of Standards

Kenneth C. Spengler, American Meteorological Society, Boston

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Harold E. Finley, Howard University

James L. Giddings, Brown University

Paul B. Sears, Yale University

Frank J. Soday, General Dynamics Corporation

Frank Bradshaw Wood, University of Pennsylvania

Popular Science Books

Harrison Brown, California Institute of Technology

Barry Commoner, Washington University

E. U. Condon, Washington University

Kirtley F. Mather, Harvard University

Retirement Plan (must be composed of three staff members)

Dael Wolfe, AAAS, chairman

Hans Nussbaum, AAAS

Raymond L. Taylor, AAAS

Committees To Be Appointed

AAAS Socio-Psychological Prize, Judges

AAAS—Westinghouse Science Writing Awards, Screening Committee

AAAS—Westinghouse Science Writing Awards, Judges

Theobald Smith Award in the Medical Sciences, Judges

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American Standards Association Sectional Committee on Letter Symbols and Abbreviations for Science and Engineering

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Committee on the Kimber Genetics Award of the National Academy of Sciences

Tracy M. Sonneborn, Indiana University

Council of Old World Archeology

Richard K. Beardsley, University of Michigan

Instrument Society of America Committee on Research and Development

Jesse W. Beams, University of Virginia

Joint Commission on Mental Illness and Health

Ernst Mayr, Museum of Comparative Zoology, Harvard College

National Conference on FAO

Noble Clark, University of Wisconsin

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Douglas M. Whitaker (1961), Rockefeller Institute for Medical Research

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U.S. Committee on ISO Technical Committee 37—Terminology

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U.S. National Commission for UNESCO

(To be appointed)

New AAAS Symposium Volumes

Biological and Chemical Control of Plant and Animal Pests, Louis P. Reitz, Ed. Papers from a symposium presented 28–30 December 1957 at the Indianapolis meeting of the AAAS. Probable publication date, March 1960.

Water and Agriculture, Roy D. Hockensmith, Ed. Papers from a symposium presented 29–30 December 1958 at the Washington meeting of the AAAS. Probable publication date, April 1960.

Calcification in Biological Systems, Reidar F. Sognnaes, Ed. Papers from a symposium presented 29 December 1958 at the Washington meeting of the AAAS. Probable publication date, May 1960.

Congenital Heart Disease, Gordon K. Moe, Ed. Papers from a symposium presented 29–30 December 1958 at the

Washington meeting of the AAAS. Probable publication date, May 1960.

Oceanographic Symposium, Mary Sears, Ed. Papers from the morning lectures presented 31 August to 11 September 1959 at the First International Oceanographic Congress in New York. Probable publication date, July 1960.

AAAS Membership

1) Changes during 1959

New members elected	7,165
Losses	
Deaths	444
Resignations	2,561
Dropped for non-payment of dues	2,736
Total loss	5,741
Net increase during 1959	1,424

2) Totals as of 31 December 1959

Annual members in good standing	53,175
Life and emeritus members	1,072
Total in good standing	54,247
In arrears	4,327
New for 1960	718
Total membership	59,292

A Report of the Chicago Meeting

Raymond L. Taylor

From all reports, the recent seventh Chicago meeting of the American Association for the Advancement of Science was one of the smoothest running and most generally successful of the 126 national meetings the AAAS has held. Though there were instances of overcrowded session rooms—commonly due to underestimates of expected attendance but, in any event, tributes to the programs scheduled in them—usually it

was possible to make transfers. It was also possible to meet last-minute requests for projection because the Committee on Physical Arrangements wisely had provided extra equipment and not only had scheduled an operator for every session that had originally requested lanterns, but had several projectionists in reserve. Besides the sessions for programs, such aspects of the meeting as registration, traffic in the ex-

hibit and Science Theatre areas, and the various social functions, in general, went very well.

The quality of the programs was uniformly high and pleased comments were heard on every hand; those who arranged the sessions naturally were gratified at the good attendance and applause. The exhibitors, too, obviously were pleased with the serious attention their displays received.

The four hotels that housed the 18 sections and 101 participating organizations were so convenient to one another that virtually all registrants, it is believed, saw the exhibits at least once. Incidentally, the policy of restricting admission to the Exposition to those with registration badges—and registering no one younger than 16—was a decided success and will be continued. There were a few disappointed parents who felt that exceptions should be made for their exceptionally talented young children, but most people who inquired appreciated that the exhibits were designed

for professional scientists and other science-minded adults. This policy does not imply lack of interest in science-minded young people. The separate Junior Scientists Assembly, arranged by the Association's Academy Conference, and the Traveling Science Libraries, (now modified for, and circulated to, elementary schools as well as high schools) provide ample evidence to the contrary.

With 4636 paid registrants the seventh Chicago meeting was the fifth largest meeting among the 126 national conventions the 111-year-old AAAS has held. (The meeting was surpassed in size only by the New York meetings of 1949 and 1956, the Chicago meeting of 1947, which included the annual meetings of the entomologists and of nearly all of the larger biological societies, and the Washington meeting of 1958.) It is an impressive total when it is borne in mind that, in 1959, though 17 organizations held their annual meetings with the AAAS, none of the larger societies was represented except with a special program or as a cosponsor. The registration total thus affords eloquent evidence that the programs of the Association as a whole, of its 18 sections, and of the numerous regional and special meetings—in the aggregate—continue to make the AAAS meeting one of the largest as well as most significant scientific meetings of the year.

Since symposia and addresses predominate, it is further indicated that well-planned programs of this type, with well-chosen speakers, will draw an attendance from all parts of the nation.

Unfortunately, the weather that prevailed the first half of the meeting was unfavorable. Eastern airports were fogged in and flights were canceled. It is quite probable that if the skies had been clear, the additional few hundred registrants needed to have exceeded the 4940 of the previous Chicago meeting would have been present. In addition to the 4636 who registered, there were several thousand others who attended technical sessions, the evening addresses, and the brilliant lecture by George Gaylord Simpson especially arranged for the interested public.

The Chicago meeting's total of 307 sessions, summarized in Table 1, included programs sponsored by the Association as a whole, by all 18 AAAS sections, by two AAAS committees, and by 49 organizations that arranged programs varying from 1 to 16 sessions in length. In addition, there were 50 other participating organizations that official-

Table 1. Analysis of sessions at the seventh Chicago meeting.

Sessions for symposia, invited papers, and panels	137
Sessions for contributed papers	32
Sessions with addresses or lectures	30
Business sessions	40
Meals or social functions	51
Tours and field trips	5
Sessions for motion pictures	10
Junior scientists assembly	2
Total number of sessions	307

ly cosponsored programs of appropriate sections and societies.

Since all 18 AAAS sections had sessions, there were programs of interest to specialists in all the principal fields of science as well as interdisciplinary symposia for those who realize the contributions that one science may make to another. There were 51 social functions exclusive of small private parties. The comfortable book lounge of the Society of Systematic Zoology, the room of Sigma Delta Epsilon, and other headquarters rooms where business meetings, conferences, or spontaneous discussions could be held in comfort were welcome features.

It was possible to concentrate more than half of the meeting in the 1800-room, 44-story Morrison Hotel, AAAS Headquarters. The remaining sessions, with a very few exceptions—notably the Chicago Academy of Sciences—were located in the Sherman, La Salle, and Hamilton hotels, all within two blocks of one another.

Arrangements for the Meeting

The fact that the 126th AAAS meeting was particularly smooth-running and generally pleasant is a tribute to the many individuals—from program chairmen and AAAS office personnel to skilled workmen, porters, and high-school teachers—who contributed their thought and services to the planning and final operation of a meeting as large and uniquely complex as this one.

In general, the hotels used had enough session rooms of the right sizes, and these were adequately furnished and equipped. There were no known instances of failure of microphones, and nearly all projection went smoothly. The hotel personnel, from managers to bell-boys, were capable and cooperative.

The local committee on physical arrangements always has one of the most taxing assignments. For the Chicago meeting, nearly 200 projectors had to

be set up, and additional screens for rooms without them had to be located. Under the chairmanship of AAAS member James H. Smith (associate superintendent of the Chicago Public Schools), this committee was hard-working and efficient. Two key members of this committee were vice chairman Hobart H. Sommers (assistant superintendent), who played an active part, and James P. Fitzwater (director of visual education), who collected the many pieces of projection equipment—all except 16 mm film projectors—from the school system. The operators, also secured by the committee, were principally volunteer school teachers, supplemented by members of the participating societies and by graduate students. All who attended the meeting are much indebted to those named and to everyone else who gave his services for this essential phase of the meeting.

Housing and registration were ably handled by experienced staff members of the Chicago Convention Bureau. The booth layout and the Science Theatre were well handled by Morrison Hotel departments. The professional guard service supplied men who generally did their jobs with understanding and courtesy. The AAAS office, AAAS pressroom, information center, and the AAAS booth, all in the Morrison, were manned by AAAS staff who came from the Washington office, 21–25 Dec. Thanks are due all for their devoted services, which so greatly contributed to the meeting's success.

Registration slips were collected from three registration points at intervals throughout each day. The slips were quickly sorted into alphabetical order and carefully posted in the Visible Directory of Registrants, in the foyer leading to the exposition rooms and ballroom. A paid worker and volunteers handled the posting, and a staff member answered the Visible Directory telephone. They also assisted registrants in rapidly locating names or adding hotel-room data to their slips. The capacity of the directory permitted additions to be made without continual rearrangement of the slips already posted.

Pattern of the Meeting

One aspect of the Chicago meeting, apparent and noteworthy, was the balance between programs of appeal to specialists, to those interested in interdisciplinary areas, and to those con-

cerned with matters of concern to all scientists. In addition, there were sessions for the science-minded public and even two afternoon events for high-school science students. There was also an excellent balance among the physical, biological, social, medical, and other sciences. The multisessioned programs of 18 different sections ensure that no principal field of science is neglected. The sectional programs expand or contract according to the number and identity of the societies that meet with the AAAS in a particular year.

Over the past decade, the pattern of the Association's annual meeting has gradually moved toward a well-balanced meeting. Partly this has been in response to the suggestions made by the Committee on AAAS Meetings, which plans the General Symposium, and the section secretaries who, jointly with the committee, devote much time and thought to how the meeting can be improved; partly it reflects the parallel thinking of the participating societies.

Within the limits of the available physical facilities, societies affiliated with the AAAS are welcome to meet with the Association on any scale preferred—full national meeting, a special or regional meeting, or simply the co-sponsorship of a program arranged by a section or other society. There is a tendency for more societies to participate each year—there were 101 such organizations at Chicago—but usually no one society's meeting requires an excessively large number of concurrent session rooms, nor does any large bloc of societies within one discipline take up a disproportionate part of the entire program. By the cooperation of the sections and of most of the societies, it now is possible to keep relatively clear one evening and one afternoon for the two parts of the AAAS general symposium. In the evenings, too, events that conflict are eliminated or kept to a minimum.

Highlights of the Meeting

One innovation at the Chicago meeting was the addition of an evening address sponsored by the recently affiliated Tau Beta Pi Association, coordinate with the other special sessions or evening events for the attendance as a whole. The first Tau Beta Pi speaker was T. Keith Glennan, administrator of the National Aeronautics and Space Administration. His address, "A new order

Table 2. Comparison of AAAS-sectional programs and society programs.

Item	AAAS sections, committees, and conferences	Participating societies	Total number of sessions with papers	Total number of speakers
Sessions for symposia, invited papers, and panels	71 (410 speakers)	66 (372 speakers)	137	782
Sessions for contributed papers*	21 (181 papers)	11 (98 papers)	32	279
Sessions with addresses or lectures	20 (38 speakers)	10 (19 speakers)	30	57
Business sessions	19	32		
Total			199	1118

* Each paper is assumed to have been presented by a single speaker.

of technological challenge in the nation's space program," given 27 December to a large and interested audience, will appear in the February 1960 issue of *The Bent*, the Tau Beta Pi Association's quarterly.

Another innovation, in recent years at least, was the provision for a Popular Lecture, planned especially for the science-minded public. At Chicago, on the evening of 29 December, George Gaylord Simpson, Museum of Comparative Zoology, Harvard College, spoke on "The world into which Darwin led us." The audience, which nearly filled the large ballroom (capacity 2000) of the Hotel Sherman, included a number of the attending scientists as well as the lay public for which it was intended. His paper will appear in *Science*.

On the same evening, the Society of the Sigma Xi and the United Chapters of Phi Beta Kappa jointly presented Lee A. DuBridge, president of California Institute of Technology, who spoke eloquently on "The adventure of learning" to an equally large and attentive audience.

On 30 December, the annual lecture and film of the National Geographic Society, this year on "Dzibilchaltun: lost city of the Maya," was given by E. Wyllys Andrews, associate in archeology at Tulane University.

Still another innovation—an experiment—was a "Dutch treat" social hour following two of the evening addresses. It was more successful the second time when the presiding officer made it clear that the refreshment arrangements in the rear of the room were not for a large private party, but for AAAS registrants who might prefer to sit down at tables where they were than to visit a public cocktail lounge.

Fourteen of the 18 AAAS sections sponsored vice-presidential addresses, and other presidential addresses were given under the auspices of the participating societies. Most of these are mentioned in the separate reports which appear elsewhere in this issue.

AAAS Presidential Address and Reception

On 28 December, the customary evening, the traditional address of the retiring (111th) president of the Association, Wallace R. Brode, was given before an audience that nearly filled the large Terrace Casino (capacity 2000) of the Morrison Hotel. President Paul E. Klopsteg presided and introduced Edward L. Ryerson, former chairman of the board of Inland Steel Company, and general chairman of the seventh Chicago meeting, who graciously welcomed all visiting registrants to the scientific community of Chicago, now the world's leading steel-producing region and a great center of technology. Retiring president Brode's paper on the steps needed to center full responsibility for government science programs in the government, entitled "Development of a science policy," has already been published [*Science* 131, 9 (1 Jan. 1960)].

Members of the platform party included Ryerson and all but one member of the Board of Directors. Each one was introduced. The AAAS reception which followed was well attended. The receiving line included members of the platform party and a number of their wives. For those in the line, it was, as always, a pleasure to be able to greet so many members and friends of the Association.

AAAS General Symposium

The general symposium of the Association, "Moving Frontiers of Science IV," which is planned by the Committee on AAAS Meetings, was held the evening of 26 December and the afternoon of 27 December in the Terrace Casino of the Morrison Hotel. Part I consisted of two lectures, "How did life begin?" by Sidney W. Fox, professor of chemistry and director of the Oceanographic Institute, Florida State University, and "How can artificial satellites help scientific research?" by William H. Pickering, director of the Jet Propulsion Laboratory, California Institute of Technology. In the second session Wendell M. Stanley, professor of biochemistry and virology and director of the Virus Laboratory, University of California, spoke on "Genes, viruses and cancer," and Robert E. Marshak, chairman of the department of physics and astronomy, University of Rochester, on "Elementary particles of modern physics." Alan T. Waterman, director of the National Science Foundation, presided at both sessions.

On the morning of 27 December, the AAAS Committee on Science in the Promotion of Human Welfare sponsored a symposium, "Science and our future," that attracted a large attendance. Committee chairman Barry Commoner presided; the two papers were "The nature of social dangers of the control machines of the future" by Norbert Wiener, Massachusetts Institute of Technology, and "Acceptance and use of scientific progress" by Brock Chisholm, former director-general of the World Health Organization. H. Burr Steinbach, chairman of the department of zoology, University of Chicago, who served as discussant, materially contributed to this program.

Other Symposia

In the past ten years at AAAS meetings there has been an increasing emphasis on symposia and a relative reduction in the number of sessions for contributed papers, on the part of both sections and the societies. At the Chicago meeting, only six sections and seven societies had a total of 32 sessions for submitted short reports of current research. In contrast, the AAAS, its sections and two committees, and the participating organizations sponsored a grand total of 137 sessions for symposia

of one to five parts, panels, or invited papers on chosen subjects. Incidentally, in planning these symposia, more and more care seems to be given to the choice of topic, selection of speakers, and provision for discussion.

As Table 1 shows, there were four times as many sessions devoted to programs of the symposium type as to sessions for contributed papers, although 17 organizations were holding national meetings with the Association. Even more striking is the fact, as shown in Table 2, that the participating societies, including an additional 32 societies which held regional or special meetings with the Association, in the aggregate, had exactly six times as many sessions of this type as they had sessions for contributed papers. The total of 782 symposium participants markedly outnumbered the 336 other speakers.

Among the 137 symposia, the following were noteworthy for their interdisciplinary scope:

"Trends in the application of mathematics," sponsored by AAAS Section A (Mathematics), cosponsored by the Society for Industrial and Applied Mathematics, arranged by Brockway McMillan (Bell Telephone Laboratories).

"Structure and metabolism of collagen," sponsored by AAAS Section C (Chemistry), cosponsored by the Chicago section of the American Chemical Society, arranged by Jerome Gross (Massachusetts General Hospital).

"Great Lakes basin" (three sessions), jointly sponsored by AAAS Section E (Geology and Geography), Section M (Engineering), the Geological Society of America, American Geophysical Union, and the Association of American Geographers, arranged by George B. Maxey (Illinois Geological Survey) and others.

"Some unsolved problems in biology, 1959" (two sessions), a joint program of AAAS Sections F (Zoological Sciences) and G (Botanical Sciences), cosponsored by the American Society of Zoologists, Botanical Society of America, and the Genetics Society of America, arranged by Norman G. Anderson (Oak Ridge National Laboratory) and Barry Commoner (Washington University).

"The impact of electron microscopy on biology," joint program of AAAS Section F, the Division of Biological and Medical Research of Argonne National Laboratory, and the U.S. Atomic Energy Commission, cosponsored by the American Society of Zoologists and

the Electron Microscope Society of America, arranged by a committee of the Division, with E. L. Powers as chairman.

"Interactions in nature: a symposium on modern ecology" (four sessions), a program of the American Society of Naturalists, cosponsored by the Ecological Society of America and the American Society of Limnology and Oceanography, arranged by Arthur D. Hasler (University of Wisconsin).

"Sand dune systems: physical and biological aspects of their development" (two sessions), a program of the Ecological Society of America, cosponsored by AAAS Sections E (Geology and Geography) and G, arranged by Jerry Olsen (Oak Ridge National Laboratory).

"Biology and history in archeology," a program of Section H (Anthropology) arranged by John C. McGregor (University of Illinois).

"Technology as a backstop to anthropology and archeology" (three sessions), a program of Section H, arranged by Ray Winfield Smith (Archaeological Institute of America).

"World population and international relations," a joint session of AAAS Section K (Social and Economic Sciences), the National Institute of Social and Behavioral Science, the American Economic Association, and the Population Association of America, arranged by Donald P. Ray (National Institute of Social and Behavioral Science).

The entire group of seven sessions of AAAS Section L (History and Philosophy of Science), cosponsored by the American Philosophical Association and the Philosophy of Science Association, arranged by Herbert Feigl (University of Minnesota), dealing with theory construction in logical and historical perspectives (two sessions), empirical and conventional elements in physical theory, induction-probability-simplicity, the logic of variables and constants, philosophical issues of the quantum theory, and methodological problems of psychology and the social sciences.

"Aging" (four sessions), a program of AAAS Section N (Medical Sciences), cosponsored by AAAS Sections F, K, and Nd (Dentistry), and by the Gerontological Society, arranged by Nathan W. Shock (Baltimore City Hospitals).

"Roots of behavior: animal behavior" (four sessions), a program of the American Psychiatric Association, cosponsored by AAAS Section I (Psychology), the Section of Animal Behavior and

Sociobiology of the Ecological Society of America, and the American Society of Zoologists, arranged by Eugene L. Bliss (University of Utah).

"Germ plasm resources in agriculture: development and protection" (five sessions), a program of AAAS Section O (Agriculture), cosponsored by AAAS Sections F, G, N, and Nd, and by 15 interested societies, arranged by R. E. Hodgson (U.S. Agriculture Research Service, Beltsville, Md.).

"Science looks at the food industry," a program of AAAS Section P (Industrial Science), cosponsored by the Institute of Management Sciences, arranged by Allen T. Bonnell (Drexel Institute of Technology).

"Upper atmosphere—solar relations" (two sessions), a joint program of the American Geophysical Union and the U.S. National Committee for the International Geophysical Year, cosponsored by AAAS Section D (Astronomy) and the American Meteorological Society, arranged by John A. Simpson (University of Chicago) and Stanley Ruttenberg (National Academy of Sciences).

"Higher education and training in

emerging fields of science and technology" (two sessions), a program of the Conference on Scientific Manpower, cosponsored by the Engineering Manpower Commission, the Scientific Manpower Commission, the National Research Council, the National Science Foundation, and AAAS Section M (Engineering), arranged by a committee, Thomas J. Mills (National Science Foundation), chairman.

The Association expresses its deep appreciation to all who prepared papers for these and for the other, more specialized, symposia.

Conferences

At each AAAS meeting three recurrent conferences are held. The Academy Conference, composed of the official delegates of the 45 (now 46) academies of science affiliated with the Association and of others interested in academy affairs, following an afternoon session on junior academies, had a day of sessions which included routine reports and business, a panel discussion on current senior academy problems, and a dinner at which A. M. Winchester (Stetson University) gave the Academy Conference presidential address.

The 13th annual Junior Scientists Assembly—a program especially for high-school students sponsored by the Association through the Academy Conference—arranged by M. B. Sailsbury (Evanston Township High School), consisted of a morning session, 29 December, and an afternoon session, 30 December, both in the Little Theatre of the Museum of Science and Industry. Selected projects and exhibits were on display.

The program of the Conference on Scientific Manpower has already been mentioned.

The Conference on Scientific Communication as arranged by its program chairman, George L. Seielstad (Applied Physics Laboratory, Johns Hopkins University), had four sessions concerned with research in documentation, international communication in science, reporting scientific research, and the principles of the communication of science. In each of these sessions able speakers drew upon their experience and evoked valuable discussions.

A Conference on Encouraging the Participation of Women in Science, jointly sponsored by the American Council on Women in Science and

Sigma Delta Epsilon, was held 28 December. Alan T. Waterman gave the keynote address, and there were three panel workshops.

AAAS Business Sessions

As required by the constitution, the Association's board of directors held its fourth regular meeting of the year at the annual meeting. Two of the sessions, as usual, preceded the two sessions of the Council (27 and 30 December), which are reported elsewhere in this issue. It is gratifying to note that the Council sessions were well attended, and that at least two past presidents of the Association were present. The AAAS section officers' luncheon and business meeting, held on 28 December, was also well attended. Several members of the Committee on AAAS Meetings were present and contributed to a brief survey of the status of plans for this year's New York meeting.

Smokers

In addition to the traditional Section E Smoker for geologists and geographers, held the evening of 29 December, and the AAAS Smoker for all registrants, held the evening of 30 December, Sections F and G, for the second year, arranged a biologists' smoker, the evening of 29 December. This event was especially fitting in view of the meetings of the American Society of Naturalists, the American Society of Plant Taxonomists, Beta Beta Beta Biological Society, the National Association of Biology Teachers, and the Society of Systematic Zoology, and of the sessions of the Ecological Society of America and the Mycological Society of America, all in addition to the programs of Sections F and G. Local biological departments and societies were hosts in a real sense, since they had contributed the funds for the coffee. Those in charge were Albert Wolfson (Northwestern University), chairman, and Austin L. Rand (Chicago Museum of Natural History). Originally scheduled for the Museum, the biologists' smoker, for greater convenience, was transferred to the ballroom of the Morrison Hotel. It was a well-attended and pleasant affair.

In contrast, the AAAS Smoker was poorly attended. Though it was intended to be the terminal event of a full day, a large majority of the attendance

Table 3. Registrants by subject fields.

Mathematics and computers	135
Physical sciences	
Physics	267
Astronomy	61
Chemistry	412
Geology and geography	168
Engineering and industrial science	149
Biological sciences	
Ecology	122
Electron microscopy (in biology)	19
Botanical sciences	182
Zoological sciences	410
Genetics	103
Microbiology	56
Biology (in general, and other)	525
Agricultural sciences	62
Medical sciences	
Bacteriology	21
Biochemistry, including nutrition	171
Clinical chemistry	37
Physiology and space medicine	123
Psychiatry	38
Dental research	46
Pharmacology and pharmacy	106
Medicine (in general, and other)	280
Social and economic sciences	
Criminology	49
Social and economic sciences (in general, and other)	69
Anthropology and archeology	30
Psychology and neurophysiology	181
History and philosophy of science	47
Scientific communication	39
Science teaching	238
Education	169
General	84
No field indicated	237
Total	4636

either found two smokers on consecutive evenings a poor idea or had booked evening flights and train reservations. At the AAAS Smoker, as in past years, the Coca-Cola Company (through the Chicago Coca-Cola Bottling Company), the National Biscuit Company, and Philip Morris, Inc., donated their products. The Association gratefully acknowledges these generous and recurrent donations.

Attendance

As previously mentioned, in number of registrants (4636) the seventh Chicago meeting was the fifth largest in the 111-year annals of the Association. The number of paid registrations at the 1959 meeting substantially exceeded the registration at all other Chicago meetings except for the previous one, in 1947, which had 304 more registrants (a total of 4940). On that occasion the entomologists and most of the other larger biological societies held their national meetings with the AAAS; this is now a physical impossibility. In view of this and of the fact that air travel was blocked in the East during the first half of the meeting, the 1959 registration figure is impressive. To date, only 14 of the 126 AAAS meetings have exceeded 3000 registrants, and eight of the 14 have been meetings held in the past 11 years.

It is always true that the total attendance at any national meeting of the Association is greater than the number of registrants, since all programs and most events are open to everyone. This year nearly 100 percent of the professional scientists and teachers registered. (In the past certain societies have had a separate registration and some of their members may have regarded a "double registration" as superfluous or onerous, but there were no separate registrations at Chicago.) Always, however, there are several thousands of the science-minded general public who attend the evening lectures (particularly the Popular Lecture planned especially for them) or some other event and who do not register at all. Even a technical program for specialists may be attended by several times the number of registrants for that discipline (see Table 3). It is probable that at the Chicago meeting at least an additional 4000 individuals attended one or more of the 307 sessions. Finally, the registration total of 4636 does not

include 16 guests, 291 individuals connected with the exhibits, and 230 press representatives.

As Table 4 shows, 2013, or about 43 percent of the total number of registrants, came from Illinois. About two-thirds of these, or 30 percent of all registrants, came from the Chicago metropolitan area. The remaining 70 percent came from areas beyond commuting distance. Except for Hawaii, each of the 50 states in the nation was represented. Puerto Rico was represented by four persons; there were 26 registrants from Canada; and there were 27 scientists who represented 14 other countries. Most, if not all, of these were visiting scholars at American institutions.

The large attendance from so many geographical areas and the excellent representation at programs of each of the sections again demonstrated that, when programs of the symposium type are well chosen with respect to subject and are of high quality, a gratifying number of scientists and members of societies not meeting with the Association will travel long distances to attend them.

Table 3 shows an analysis of the 4636 registrants by subject field, except for 237 instances where the "field of

interest" line on the registration slip was left blank and where no other clues were available. Undoubtedly some of those who gave no field of interest were individuals who had registered hastily on their way to programs for which they were late. The remainder were principally wives of registrants. Between 300 and 400 wives attended the meeting, but many of these listed scientific interests. The "general interest" category includes a substantial number of research and other administrators.

In this analysis of subject fields, every effort was made to record each individual's primary interest: For example, high-school science teachers who indicated their major interest as teaching or science education were not classified as biologists or chemists, and so on. If the data on differences are grouped under still broader headings than those in Table 3, the composition of the registered attendance is as follows: physical sciences and applications, 1192 (26 percent); biological sciences and agriculture, 1479 (32 percent); medical sciences, 822 (18 percent); psychology and social and economic sciences, 415 (9 percent); science teaching and education, 407 (9 percent); general interest and other, 321 (7 percent).

The percentages for these groups

Table 4. Distribution of registrants by states and countries.

Alabama	9	Pennsylvania	120
Alaska	2	Rhode Island	7
Arizona	11	South Carolina	1
Arkansas	12	South Dakota	10
California	81	Tennessee	68
Colorado	28	Texas	44
Connecticut	33	Utah	14
Delaware	5	Vermont	5
District of Columbia	131	Virginia	54
Florida	32	Washington	12
Georgia	18	West Virginia	6
Idaho	4	Wisconsin	230
Illinois	2013	Wyoming	4
Indiana	275		
Iowa	126	Total, continental U.S.	4579
Kansas	37		
Kentucky	40	Brazil	1
Louisiana	40	Canada	26
Maine	6	England	2
Maryland	105	Germany	2
Massachusetts	67	Honduras	1
Michigan	239	India	5
Minnesota	83	Ireland	1
Mississippi	11	Jamaica	1
Missouri	80	Japan	1
Montana	6	Philippines	2
Nebraska	31	Puerto Rico	4
Nevada	1	Scotland	1
New Hampshire	5	Sweden	3
New Jersey	63	Taiwan	1
New Mexico	8	Thailand	4
New York	209	Venezuela	2
North Carolina	32		
North Dakota	3	Total, territorial and foreign	57
Ohio	130		
Oklahoma	21	Total registration	4636
Oregon	7		

have remained much the same in recent years. Over the past 11 years (except in 1957 in Indianapolis and in 1952 in St. Louis, when the physical sciences were first by a slight margin), the biological sciences have been the largest single group represented at each meeting, with, however, the physical and the medical sciences (in that order) following closely. Both the social sciences and science teaching and education have ranged from 5 to 9 or 10 percent each year.

Exhibitors of the books, instruments, and laboratory supplies which scientists and teachers use have an understandable interest in the composition of the attendance at AAAS meetings. From the foregoing data—and also in view of the fact that so many of the registrants were academic administrators, department heads, directors of research, and others in a position to decide on textbooks and other materials—it is

apparent that participation in an AAAS meeting, diversified as it is, is worth while for those who produce the things that scientists need.

Annual Exposition of Science and Industry

The 1959 Annual Exposition of Science and Industry was one of the most varied and attractive ever held. In addition to the "core exhibits" of publishers, supply houses, instrument companies, and laboratory-equipment firms, there were numerous and varied large-scale industrial exhibits—many especially built for this AAAS meeting—which were of decided interest to the thousands who saw them. The 103 booths filled the Constitution Room and the adjacent Parlors A—D of the Morrison Hotel and overflowed into the

filled to capacity throughout, was located at the far end of the exhibit area. The Visible Directory of Registrants was placed in the foyer at the entrance to the exhibits and the ballroom. These arrangements were made for the maximum convenience of the visitors to these several features and of those attending sessions in the hotel.

The local Committee on Exhibits, headed by William V. Kahler (president, Illinois Bell Telephone Company), with W. J. Peak (assistant vice president) as secretary, did an outstanding job in enlisting the interest and support of large firms in the Chicago area. The electric and electronic displays—missiles and related devices—and the demonstrations of new instruments for teachers and others in astronomy helped to make the 1959 exposition well worth repeated visits. A grateful acknowledgment of the work of the Exhibits Committee is made on behalf of the Associa-



Annual Exposition of Science and Industry

tion and of all those who enjoyed the exposition.

The names of nearly all of the 87 exhibitors and a description of their exhibits appeared both in the General Program and in the pre-convention issue of *Science* [130, 1553 (4 Dec. 1959)]. Additional exhibitors, accommodated with desk space, were Air Research and Development Command Technical Films, Bio Kit, the Filbo Company, and Particle. A last-minute cancellation by one publisher made it possible to assign a booth to the Barnett Instrument Company of Tennessee.

AAAS Science Theatre

The Science Theatre, which at each meeting since the Chicago meeting of 1947 has shown a selection of the latest foreign and domestic scientific films, is now an established feature of the annual meeting of the Association. At the seventh Chicago meeting, 16-mm films were shown in seven 4-hour programs. Each film was shown twice and some a third time. The cooperation of the lending agencies is appreciated. A few films failed to arrive on time; for these, films provided by the Educational Testing Service were substituted. All films have now been returned to their sources; inquiries concerning them should be directed to the producers.

Work of the Local Committees

A scientific meeting as large and as complex as the annual meeting of the AAAS does not just happen. It cannot take place, nor can it succeed, without the cooperation and assistance of a great many agencies and persons. Of critical importance among these are the local committees and the general chairman and subchairmen who appoint them. The Association and all who attended the seventh Chicago meeting are greatly indebted to Edward L. Ryerson, former chairman of the board of Inland Steel Company and former chairman of the Board of Trustees of the University of Chicago, who made distinguished appointments to the local committees, kept in close touch with all phases of the meeting, and graciously welcomed members and friends of the Association on the evening of 28 December. On behalf of the Association, a grateful acknowledgment of our indebtedness to Mr. Ryerson is made here.

The able work of the Committee on Physical Arrangements and of the Committee on Exhibits has already been acknowledged. The remaining committees, in their respective fields, also contributed greatly to the meeting.

The Committee on Public Information, headed by Allen H. Center, vice president in charge of public relations of the Leo Burnett Company, provided expert advice and assistance in publicizing the meeting locally. Pre-meeting announcements in the press are not readily secured (probably because a meeting is not news until it happens), but in Chicago the local scientific societies and the local press did provide a reasonable amount of advance information. The coverage during the meeting—front-page features and inside stories on two or more pages each day—was exceptional, both in quantity and quality (no one recalls such extensive coverage of any previous scientific meeting by the leading newspapers of Chicago). The Association expresses its grateful appreciation. Additional details on this, and on the national coverage during the meeting, will be found in the report by Sidney S. Negus on page 518 of this issue.

The Association acknowledges with deep appreciation the work of the Finance Committee, which, through its chairman, Harry O. Bercher (executive vice president, International Harvester Company), in advance of the meeting, solicited funds to reduce the deficit. The firms and individuals who have made contributions to date include the following:

Allied Radio Corporation
Allied Structural Steel Companies
Allis-Chalmers Manufacturing Company
American Can Company
Atchison, Topeka and Santa Fe Railway System
Walter Bledsoe and Company
Borg-Warner Foundation, Inc.
Charles Bruning Company, Inc.
Burton-Dixie Corporation
Christiana Foundation, Inc.
Columbia Pipe and Supply Company
Commonwealth Plumbing Company
Continental Can Company, Inc.
Cutler-Hammer, Inc.
Charles C. Dawe Foundation
Dole Valve Company
DuKane Corporation
Fairbanks, Morse and Company
Field Enterprises Educational Corporation
Walter H. Flood and Company

General American Transportation Corporation
General Biological Supply House, Inc.
Globe-Union, Inc.
Granite City Steel Company
Illinois Tool Works
Inland Steel Company
International Harvester Company
International Minerals and Chemical Corporation
Joslyn Stainless Steels
M. S. Kaplan Company
La Salle National Bank
La Salle Steel Company
Link-Belt Company
Oscar Mayer Foundation, Inc.
McGraw-Edison Company
John Mohr and Sons
Motorola, Inc.
Nalco Chemical Company
Peabody Coal Company
Pickands Mather Fund
Precision Scientific Company
Republic Coal and Coke Company
Sinclair Research Laboratories, Inc.
SRA Foundation
Standard Forgings Corporation
Standard Oil Company (Indiana)
Sterling Products Company, Inc.
Swift and Company
Tousey Varnish Company
Union Tank Car Company
United States Steel Corporation
Victor Manufacturing and Gasket Company
Paul Weir Company, Inc.
Western Electric Company
Westinghouse Electric Corporation
Yale and Towne Manufacturing Company
Zonolite Company
Kenneth V. Zwiener

The Honorary Reception Committee included 36 heads of public and private agencies concerned with science and education. Many were able to be present during the meeting or made a point of attending the AAAS presidential address and reception.

Other Acknowledgments

In concluding this report of the 126th meeting, besides thanking all members of the local committees, I personally wish to thank the staff of the Chicago Convention Bureau which supplied expert professional assistance and friendly help throughout, as well as management personnel and sales managers of the various cooperating hotels—especially John B. Grande, Gerald G. Sanderson, and N. A. Rickman of the Morrison

Hotel; John A. Fenchen of the Sherman Hotel; and their counterparts at the Hamilton and La Salle hotels. Their many courtesies and great assistance were essential for the success of the meeting. The secretaries and program chairmen of each section and participating organization cooperated ably,

especially in providing copy and galley proof for the 272-page General Program, published by the Horn-Shafer Company of Baltimore. Finally, the debt to W. Gilbert Horn of that firm for his able and sympathetic cooperation in seeing the "book" through the press is great.

Awards and Prize Winners

A complete list of the recipients of the awards announced at the Association's seventh Chicago meeting appeared in an earlier issue of *Science* [131, 89 (1960)] and need not be repeated here.

Public Information Service

Sidney S. Negus

Last summer Allen H. Center, vice president in charge of public relations for Leo Burnett Company, Inc., was invited to be the chairman of the local committee on public information for the Chicago meeting of the AAAS, on a volunteer basis. Fortunately for the Association, he accepted this invitation and soon had working with him 22 mass-media communication experts to help set the stage locally for the complex operation of informing the public throughout the world of the reports to be made concerning the progress of science in all its branches at this great gathering of scientists from nearly 300 organizations in this country and abroad. In early fall, Patricia Hanson of TV station WTTW (channel 11), Chicago, agreed to help arrange all radio and television programs. A team of 27, including Eleanor Pollard and myself of Richmond, with the aid of John Fenchen and N. A. Rickman of the Sherman and Morrison hotels, respectively, started to make active preparations in mid-September for this meeting, in which 18 AAAS sections and 101 other organizations participated. Various preliminary details had been cleared during the summer months. Then the usual pre-meeting procedures, which had been found more or less successful in the past, were followed [*Science* 127, 409 (1958)].

One hundred and sixty-two accredited representatives of the press, radio, and television registered in the press room at Chicago. Sixty-eight other reporters from the United States and abroad reported the meeting from nontechnical

abstracts and from complete papers mailed to them upon request before and during the convention. This is approximately 80 less than the number of reporters who covered the Washington meeting in 1958.

The Chicago newspapers did an outstanding job of science reporting, thanks especially to Arthur J. Snider of the *Daily News*, Roy J. Gibbons of the *Tribune*, Robert S. Kleckner of the *Sun-Times*, and Effie Alley of the *American*. The Association appreciates Mayor Richard J. Daley's proclamation of 26-31 December 1959 as Science Week in Chicago.

International coverage by reporters for the wire services and science writers for newspapers and magazines was especially good, as far as can be determined from clippings and letters sent to the Association by friends. Since the meeting, requests have been received from individuals in 32 countries for more information about specific papers on the program.

Feature stories, not requiring close deadlines, are beginning to appear in various publications. As is usually the case, quite a few representatives of magazines registered in the press room solely to get ideas for future articles. Some of these articles may not appear for months and then, when they do appear, will carry no particular credit reference to the Chicago AAAS meeting.

National radio and television coverage was not up to the usual standard of AAAS meetings. There were only seven coast-to-coast broadcasts, whereas

at last year's meeting in Washington there were 11. In my opinion, broadcasting companies nationally are not as alert to the news in a great gathering of scientists as are the leading world newspapers and magazines, which employ expert science writers on their staffs. The daily local coverage by radio and television stations in the Chicago area, however, was exceptionally good. Thanks for this attention to timely news about science in general is extended by the AAAS public information service to stations WBBM (TV and radio), WNBQ-TV, WIND (radio), WBKB-TV, WGN (TV and radio), WAIT (radio), WCFL (radio), WLS (radio), WJJD (radio), and WAAF (radio) and to TV station WTTW (channel 11).

The American Tobacco Company Research Laboratory contributed daily coffee breaks for reporters working in the press room. Armour and Company's Research Division had luncheon served for science writers on one of the busy days in the Hollywood room. Fresh orange juice in the pressroom during the convention was contributed by the Florida Citrus Commission. The General Electric Company Research Laboratory suite, long a rendezvous for science writers at AAAS gatherings, held open house for three evenings. The reception and dinner arranged by the Westinghouse Electric Corporation for science writers was especially well attended by reporters. The Association is grateful to these friends of its public information service for helping to make enjoyable the extremely intensive task of reporting a meeting of this magnitude to the general public. To Paul E. Klopsteg, AAAS president at the time of the meeting, Wallace R. Brode, immediate past president, Chauncey D. Leake, AAAS president as of 15 January 1960, Dael Wolfle, AAAS executive officer, Raymond L. Taylor, associate administrative secretary in charge of arrangements for the Chicago meeting, and the AAAS Board of Directors go the thanks of this department, also, for giving it a free rein to function as it deems best for the Association.

Thelma C. Heatwole, technical editor for Armour and Company, Research Division, was director of the press room. After this experience for eight consecutive annual meetings of the Association, she has become an expert among science writers of the country as an intermediary between scientists and the press. She arranged 17 press conferences during the meeting. Allen H. Center and Patricia Hanson maintained their headquarters in the press room, and the latter had

a special suite at the Morrison Hotel for radio and television interviews. These individuals, with the help of Foley F. Smith of Richmond, Mrs. Hjalmar W. Johnson and Marion E. Pretzel of Chicago, C. W. Hoerr and Jean D'Ottavio of Armour and Company's Research Division, John Jacoby of Flushing, New York, and William Haskell and Eleanor O'Hara of the AAAS staff, provided source material quickly for the science writers covering the meeting. Largely

to these reporters goes the credit for attaining, through these annual meetings, one of the four principal objectives of the Association: increasing public understanding and appreciation of the importance and promise of the method of science in human progress.

The Association deeply appreciates the world-wide coverage of its meetings by members of the National Association of Science Writers and other representatives of the fourth estate.

Reports of Sections and Societies

chines use to understand them. More significant is the fundamental nature of the languages, whether oriented toward the machine itself or toward the problem to be solved. There are several problem-oriented languages now under development, some of which were described and illustrated.

C. C. MACDUFFEE, *Secretary*

Physics (Section B)

A series of reports on recent advances in physics was the major theme of the 1959 program for Section B. David Inglis summarized progress on the subject of nuclear structure and pointed out some of the remaining unsolved problems. New ideas developing throughout the world on multi-Bev accelerators were presented by Keith R. Symon. Marcel Schein reported on current advances in high energy cosmic rays. After first presenting an analysis of what is meant by problems in theoretical physics, Harold W. Lewis reviewed some of the major unsolved problems in theoretical physics still extant. On behalf of the atomic structurists, Richard H. Sands reported on recent experiments concerned with the orientation of atoms, electrons, and protons. Walter L. Hyde gave a review of recent discoveries made on the physical and geometrical processes occurring in filament optics. The retiring vice president, Robert B. Lindsay, discussed, with a philosophical orientation, possible connections between ethics and thermodynamics.

J. H. McMILLEN, *Secretary*

Chemistry (Section C)

Many thanks to our chairman, John A. King, director of research, Armour and Company; to our program chairman, Sidney Archer, Sterling-Winthrop

Mathematics (Section A)

Section A had three meetings. At 4 P.M. on Saturday, 26 December, R. H. Bing (University of Wisconsin), retiring vice-president, gave his address, "Topology of Euclidean three-space," discussing the present state of knowledge in this field.

On Sunday at 9 A.M. there were four invited addresses on "The New Look in Mathematical Education." G. Baley Price (University of Kansas and the California Institute of Technology) reported on the work of the Committee on the Undergraduate Program, giving a brief statement of the background of this committee, what it wishes to accomplish in modifying the mathematical curricula in American colleges, and the success that has so far attended its efforts. Henry Swain (Winnetka, Ill.) spoke in particular of the new ninth grade course devised by the School Mathematics Study Group, of which he is a member, and emphasized the success that pilot classes have had with this curriculum. Morris Kline (New York University) objected to the present trend of curriculum planning committees and made a plea for teaching the applications of mathematics to physics and engineering. William M. Duren, Jr. (University of Virginia), stated that analytic geometry is now being required for entrance by most eastern colleges, and he

predicted (without endorsement) that before long elementary calculus will be so required.

On Monday at 9 A.M. there was a symposium on Trends in the Applications of Mathematics cosponsored by Section A and the Society for Industrial and Applied Mathematics. Mina Rees (Hunter College) presided, and opened the symposium by emphasizing the increased use of modern mathematics by industry. R. F. Drenick (Bell Telephone Laboratories) spoke on random processes in control and communications. He stated that the theory of random processes utilizes many modern concepts (sets, measures, spaces of infinite dimensionality) and leads to results which hold true on the average. Its application has been strikingly successful in control and communications engineering, and in statistics. Philip Wolfe (Rand Corporation) spoke on mathematical programming and the allocation of resources. An allocation problem and a problem from the biological sciences were described and formulated as mathematical programming problems, and it was indicated how the theory of these problems leads to computer techniques for their solution. The final paper, on computers, computation and computer languages, was presented by Francis V. Wagner (North American Aviation). Computing languages are classified according to the techniques that the ma-

Research Institute; to the symposia chairmen; and to the officers of the Chicago section of the American Chemical Society for the unusually good programs of Section C at the 7th Chicago meeting of the AAAS.

The symposium on the Structure and Metabolism of Collagen (arranged by Jerome Gross of Massachusetts General Hospital) included the following papers: "Structure of collagen" (Alexander Rich); "Collagen-gelatin transition" (Peter H. Von Hippel); "Unusual linkages in collagen" (Paul M. Gallop and Albert Einstein); "Biosynthesis of collagen" (David S. Jackson); "Collagen defect in vitamin C deficiency" (William B. Van Robertson); "Collagen defect in lathyrism" (Jerome Gross); and "Immune reactions of collagen" (Sidney Rothbard). These papers added to the holiday enlightenment of about 150 scientists.

A symposium session on Some Recent Developments in Organic Chemistry (arranged by Sidney Archer of Sterling-Winthrop Research Institute) included the following: "Organic chemical models of enzymatic hydrolysis" (Myron L. Bender); "Practical procedures for the sodium-ammonia-alcohol reduction of aromatic compounds" (Hugh L. Dryden, Jr., Gayle M. Webber, Robert R. Burtner, and John A. Cella); "Mechanism of proton transfer processes" (Howard E. Zimmerman); and "Specific solvent effects in the alkylation of enolate anions" (Harold E. Zaugg). If you were not present, you missed an opportunity for "Adventure in Learning."

The symposium on Some Recent Advances in Inorganic and Nuclear Chemistry, also timely (arranged by J. J. Hatz of Argonne National Laboratory), covered the areas of: "Recent experimental studies of nuclear fission" (John R. Huizenga); "Current problems in mechanisms of complex ion reactions" (Henry Taube); and "Rates of mechanisms by magnetic resonance" (S. I. Weissman)—another good program you missed if you did not attend the 126th meeting of the AAAS.

A follow-up to the preceding symposium was one on High-Energy Radiation Chemistry of Proteins and Amino Acids (arranged by W. D. Bellamy of General Electric Research Laboratory), with the following: "Introductory remarks" (W. D. Bellamy); "Physiological changes in irradiated proteins" (Virgil L. Koenig); "Chemical changes in irradiated proteins" (D. M. Doty); "Analytical methods used in the study of irradiated proteins" (C. Merritt, Jr.); and "Irradiated

amino acids" (Charles Maxwell). This symposium presented the current status of irradiation studies on amino acids and proteins.

In addition to these four symposia sessions, the chemistry program included 17 submitted papers (arranged by Edmund Field and E. K. Fields, both of Standard Oil Company of Indiana) covering the topics: "Polarizability of valence electron groups" and "A new approach to the classification of the low-valence ions" (Henry Tolkmith); "Association constant of nitroethane" (Boris Musulin and Roy Lee Foley); "Potentiometric titration and equivalent weight of humic acid" (Alfred M. Pommer and Irving A. Breger); "Potentiometric titration and electrolytic behavior of montmorillonite" (Alfred M. Pommer and Dorothy Carrol); "Sodium ozonide" (Irvine J. Solomon); "Selective liquid adsorption with alkali metals on active carbon" (W. F. Wolff, Philip Hill, and G. D. McLeod); "A radioactive tracer study of reactions at the surface of a metal undergoing wear" (A. I. Snow); "Unusual reactions of a highly conjugated lactone system" (Robert Filler and Edmund J. Piasek); "Organic isooctenyl alcohol esters" (R. L. Foster, S. H. Patinkin, and D. W. Young); "Relationship between structure and diuretic activity in the 1,2,4-benzothiadiazine series" (James H. Short, Ursula Biermacher, Leonard E. Brady, Warren J. Close, Leo R. Swett, and Maynette Vernsten); "Effects of diethylstilbestrol upon pituitary tissue" (Birute M. Baltrusaitis and Jacklyn B. Melchior); "Urease and citrate production by pathogenic gram-negative bacilli" (H. Seneca, J. K. Lattimer, H. H. Zinsser, O. K. Troc, and P. Milner); "New specific activities of ultraviolet light in the catabolism of tryptophan and serotonin" (Anwar A. Hakim); "Irradiation 'factor-dependency': some vinyl monomers" (Ed. F. Degering, G. J. Caldarella, and M. Mancini); "Lipid biosynthesis during frozen storage of plant tissue" (J. S. Blair); and "Mechanism of the Diels-Alder reaction" (M. J. S. Dewar).

Under the guidance of our new chairman, R. W. Schiessler, technical director of the Central Research Division of Socony Vacuum Oil Co., and S. L. Meisel of the same laboratory, who is the new four-year committeeman of the Chemistry section, we can look forward to a good, interesting, and informative program at the 127th meeting of the AAAS in New York, 26-30 December of the current year.

Now is the time to begin to formulate

your plans for attending the New York meeting and for giving careful consideration to the presentation of a top-rate paper before the Chemistry section.

ED. F. DEGERING, *Secretary*

Astronomy (Section D)

The program of Section D consisted of two well-attended symposia and the address of the retiring vice president. On the morning of 26 December a symposium on the solar system, cosponsored by the American Astronautical Society, and arranged by Gerard P. Kuiper, was held. This symposium is described in the next report.

The afternoon session included a symposium on "astronomical photoelectric photometry, cosponsored by the Astronomical League. The first section was arranged by Arthur D. Code and was comprised of the following papers: "History and development of astronomical photoelectric techniques," by C. M. Huffer (Washburn Observatory); "Studies of variable stars and galactic structure by photoelectric methods," by F. B. Wood (University of Pennsylvania); "Ultraviolet detectors for astronomical photoelectric photometry," by C. Childs and L. Dunkelmann (Goddard Space Flight Center); and "Future advances in photoelectric techniques," by T. E. Houck (Carnegie Institution of Washington). The second section was arranged by Edward A. Halbach of the Astronomical League. This included papers on "Designing a good photoelectric photometer to meet the amateur's budget," by Walter L. Moore (University of Louisville); "Flare of AD Leonis observed by photoelectric photometer," by Donald Engelkemeir (Argonne National Laboratory); and "Photoelectric program of the AAVSO," by John J. Ruiz (Dannemora, N.Y.).

The final event of the program was the address of the retiring vice president, with vice president Ira S. Bowen of Mount Wilson and Palomar observatories presiding. The retiring vice president, Dirk Brouwer, of Yale University Observatory, spoke on "The needs of astrometry in the Southern Hemisphere."

FRANK BRADSHAW WOOD, *Secretary*

The Solar System

The proceedings of the symposium on the solar system followed the printed program. All speakers were present in person and presented their papers in the

order listed. Because I had a cold, it was arranged that I. S. Bowen would preside over the meeting, but I gave my own paper as scheduled.

Anders presented important information on the argon losses of meteorites depending on temperatures from which it followed that the meteorites are fragments of bodies kept at very low temperatures during nearly all of their lives. This is compatible with their origin from the asteroid ring, but not compatible from their origin as fragments of the moon. Sinton presented his new material on lunar heat maps which showed that the maria are somewhat hotter than the uplands. Arthur gave a critical review of the present status of lunar cartography and stated conditions which must be met in future mapping programs such as are now being undertaken. Kuiper presented his thoughts on the Moon, based on a series of photographs taken from the material incorporated in the new photographic lunar atlas now in press. Drake reviewed the recent radio observations at wavelengths 3 cm to about 1 m for the planet Jupiter and showed that two emissions are present, one thermal, corresponding to a temperature of about 130°K, and one nonthermal which he interpreted as due to the equivalent of a Van Allen belt around Jupiter. This implies the presence of a magnetic field of the order of 5 gauss at the surface of Jupiter. He also reviewed the Venus measurements which appear to leave no alternative but to assume that the surface of that planet has a temperature of about 300°C.

The symposium was well attended by scientists representing many different fields.

G. P. KUIPER, *Symposium Chairman*

Geology and Geography (Section E)

Section E held two symposia, one on quantitative terrain studies and the other on the Great Lakes Basin, and cosponsored three others on economic changes in underdeveloped areas (organized by the Illinois Geographical Society), on the origin and development of limestone caverns (organized by the National Speleological Society), and on the geographers' role in transportation studies (organized by the Association of American Geographers).

Since World War II, a trend toward quantitative study of landforms has been much accelerated, with research in the subject going on at a number of institutions. The symposium on quantitative

terrain studies brought many of the workers in the field together for the first time to discuss statistical analysis of terrain and the important related subjects of sampling techniques, methods of map presentation of data, and the influence of scale on the type of data derived from the study of topographic maps. Speakers also described several recently developed techniques for terrain study such as the use of radar and spectral reflectance.

The best attended session of Section E was the symposium on the Great Lakes Basin, which attracted an audience of about 150 to each of its three half-day sessions, which included discussion of the characteristics of the basin, based upon its geologic setting; its water circulation and the influence of climate thereon; the changes in chemical composition of the lake waters as a result of man's activities; and man's adaptation in the basin.

Besides the symposia, the program included four papers on Southwest Asia, arranged by the Association of American Geographers. These papers were concerned with the contributions of mammalogy, botany, and glacial geology to archeological studies.

Byron N. Cooper presented, as his vice presidential address, a paper entitled "Rôle of subsidence in the origin and evolution of the Appalachian Mountains," in which he pointed out the far greater thickness of sediments in synclines as compared to anticlines which, with other evidence, points to a mechanism of subsidence resulting in folding and faulting.

FRANK C. WHITMORE, *Secretary*

Association of American Geographers (E1)

The Association of American Geographers sponsored two sessions: (i) a symposium on the geographers' role in transportation studies, and (ii) a session of papers on Southwest Asia and North Africa.

The transportation symposium was opened by Edward J. Taaffe (Northwestern University), who indicated that the session was essentially a discussion of applied geography with the Chicago Area Transportation Study as a case study. The first three participants, E. Wilson Campbell, John R. Hamburg, and Robert Sharkey, then presented, in order, the history, scope and purpose of a transportation study, and methods of obtaining and compiling factual information on land use, floor inventory,

and travel within the area. Garred Jones then presented methods of using this information by means of punch cards and magnetic tape in the preparation of maps, models, and other aids to be used in planning Chicago's highway system.

The second session, chaired by Alden Cutshall, contained four papers. H. E. Wright, Jr. (University of Minnesota), in discussing late Pleistocene glaciation in Southwest Asia, indicated that cirques are found as low as 5000 feet and morainal deposits in valleys as low as 2500 feet. Charles Reed, an environmental zoologist (University of Illinois Professional Colleges), traced the continuity of animal life during the late Quaternary in northern Iraq as recorded in the archeological sites of the area. Both speakers indicated that the incipient cultivation and animal domestication which began in this area some 10,000 years ago cannot be correlated with any discernable end-of-the-Pleistocene climatic change. There appears to be no environmental stimulus, or challenge.

Karl Butzer (University of Wisconsin), speaking from his studies in Egypt, further emphasized that there is no scientific basis to the theory of progressive desiccation—that is, there is no evidence of negative environmental anomalies invoking positive human reactions. Neither in Egypt nor in Mesopotamia, then, can Toynbee's physical challenge theory be applied.

Marvin Mikesell (University of Chicago) presented a stimulating inductive approach to plant ecology with examples from northern Morocco. After studying clumps of forest preserved on sacred sites, along with other evidence, he concluded that the potential vegetation of northern Morocco should be a wooded ecotone.

ALDEN CUTSHALL, *Program Chairman*

Illinois Geographical Society (E3)

The Illinois Geographical Society cosponsored, with Section E, a symposium on economic changes in underdeveloped areas. Helen L. Smith described some problems in the development of Thailand's agricultural economy. Agriculture is the means of livelihood for 84 percent of the people of Thailand. Commercial rice production is centered on the Central Plain, where natural conditions are far from ideal. Conditions of alternating drought and super-abundant rainfall are being somewhat overcome by irrigation projects. Diversification of agricultural crops, especially "upland crops," is taking

place as a result of improved transportation facilities and water control.

Robert O. Johnsrud discussed post-war economic changes in Nigeria. Nigeria has predominately a subsistence economy but there has been an increase in the commercial economy, especially in the south-central, southwest, and north-central regions. There has been more of a commercial revolution than an industrial revolution. Groundnuts, palm kernels, and cocoa have been grown more intensively in the old producing areas. The welfare type of government has tended to restrict the economy.

Floyd F. Cunningham discussed recent changes in the economy of Egypt, United Arab Republic. Land reform has been concerned with limiting the size of holdings. The country has 6 million acres of arable land. There are great possibilities for developing additional arable land in the "New Valley," a series of five large oases with much underground water extending northwestward from Aswan. Plans have been made to expand irrigation and hydro-power, transportation, and industrialization.

The Philippines, described by Alden Cutshall, are a patchwork of old and new patterns. New, are the beautiful modernistic buildings, housing projects, highways, Japanese diesels for the railroads, and the use of the Jeepny and bus. Power stations, steel mills, fertilizer plants, and petroleum refineries represent industrial progress. Cottage industries produce wooden shoes, rice pots, and textiles. In general, farming methods are still primitive. New, are threshing machines, storage facilities for rice, improved cattle types, and crop diversification. Old, are the rice terraces of Luzon. Philippine progress is conditioned by the problems of the newly independent; nevertheless it is noteworthy.

Robert L. Carmin described economic changes in the region of Brazil's new capital, 1945-59. In anticipation of the move of the capital of Brazil to a new site in the state of Goiaz, scheduled for early in the 1960s, government buildings and housing projects are under construction. The railroad has been completed as far as Anapolis. A paved road to Brazilia is in use, and its extension to Belim is proceeding. The population has increased 47 percent in the past decade. Pioneer settlements follow the highways, and squatters are often a problem to owners. Truck transporta-

tion promises to exceed in importance that of the railroad. Pioneer agriculture consists of livestock raising and subsistence farming.

MARY GRANT, *President and Program Chairman*

Zoological Sciences (Section F)

The program of Section F included five sessions of contributed papers in the areas of cell studies, development biology and morphology, endocrinology and physiology, and two symposia. The symposium on the organization of the cell arranged by Norman G. Anderson (Oak Ridge National Laboratory) and cosponsored by Section G, the American Society of Zoologists, and the Botanical Society of America continued the series on "Unsolved Problems in Biology." A second symposium of eight papers on the impact of electron microscopy on biology, arranged by E. L. Powers, B. R. Nebel, and F. Wassermann (Argonne National Laboratory) was made possible through the sponsorship of Argonne National Laboratory and the Atomic Energy Commission. This symposium, cosponsored by the American Society of Zoologists and the Electron Microscope Society of America, is separately reported below. Both symposia were interdisciplinary in nature and presented stimulating discussions of the directions of current research.

Zoological groups in the Chicago area were cordial hosts to zoologists attending the meeting. They generously contributed funds for the Biologists' Smoker, and through the splendid work of the local committee (Albert Wolfson, A. L. Rand, and Orlando Park), made arrangements for the Smoker and the Zoologists' Banquet. The banquet was a particularly pleasant occasion. Albert Wolfson was master of ceremonies. Herbert Friedmann, chairman of Section F, addressed the group on "Current changes in the environment of zoological research," and this was followed by invited comments by Paul Weiss.

KARL M. WILBUR, *Secretary*

Impact of Electron Microscopy on Biology

A two-session symposium on the Impact of Electron Microscopy on Biology, sponsored by the Electron Microscope Society of America, the American Society of Zoologists, and the Atomic Energy Commission through Argonne

National Laboratory, was held on 29 December. The symposium was arranged by F. Wassermann, B. R. Nebel, and E. L. Powers, chairman, of Argonne. It was attended by about 700 persons. The papers demonstrated that the quick acceptance of the techniques of electron microscopy by biologists, in contrast to the slow development that was the history of light microscopy, has profoundly influenced concepts concerning biological mechanisms and functions in a brief period of time. The origin of organization of connective tissue; the structure and structural relationships of certain cellular constituents such as the Golgi apparatus, the chromosome, and the DNA molecule; the ultramicroscopic behavior of cells in experimental conditions; the relationship between the virus and the cell; the organization of hierarchies of organelles in the many kinds of cells; and the ultrastructural basis of function in nerves were among the subjects examined. In the introduction and summary it was stressed that while the electron microscope is another tool to be used with existing ones, and while the new knowledge must be correlated with the old, the importance of this instrument in recent biology and its great promise in the biology of the immediate future were demonstrated frequently and forcibly in this symposium.

E. L. POWERS, *Program Chairman*

Ecological Society of America (FG6)

The program of the Ecological Society of America consisted of three sessions of contributed papers, on animal ecology, plant ecology, and general ecology. Symposia included a two-session program on sand dune systems arranged by Jerry Olson and cosponsored by Section E, and a four-session program on interactions in nature arranged by Arthur D. Hasler for the American Society of Naturalists. An all-day field trip to several areas of the Indiana sand dunes concluded the program.

The contributed papers on plant ecology varied in subject from algae in Antarctica, to alpine tundra in New Zealand, to revegetation of lava and ash from a volcano, to several studies from forests. The papers on animal ecology dealt with crickets, crabs, mammals, birds, a bestiary, and further topics. Attendance at these sessions ranged upward to approximately 100.

Physical and biological aspects of dune development were discussed in a

symposium. Speakers in the first session presented data and illustrations of dune systems taken on a world-wide basis. In the second session various facets of dune environments and of dune plants studied in this country were presented. About 150 persons attended these sessions. On the field trip, attended by 16 persons, major stops were made at three areas in Indiana which illustrate differing developmental and vegetational stages of dunes.

The symposium on interactions in nature, attended by perhaps 300 persons, dealt with the place of ecology among the sciences, insect populations, community functioning, energy relationships and adaptation to environment, and animal behavior and ecology. All sessions at the meetings were marked by good audience interest and participation. A paper not included in the published program for Monday morning's session on animal ecology was, "Age at weaning *Peromyscus maculatus bairdii*," J. A. King, John C. Deshaies, and G. Doyle (University of Chicago and Roscoe B. Jackson Memorial Laboratory).

WILLIAM C. ASHBY, *Local Program Chairman*

Sand Dune Systems

The symposium on sand dune systems, cosponsored by Sections E, F, and G and the Ecological Society of America, demonstrated how physical sciences (geology, geography, meteorology) and ecological sciences (especially plant ecology and pedology) depend on each other in the study of natural landscapes.

J. Harlen Bretz, H. T. U. Smith, David Simonett, Albert M. Laessle, and William S. Cooper analyzed the processes and chronology of "Origin of dune landscapes," on the morning of 30 December. These and later papers (especially that of Charles Laing) emphasized the role of vegetation in building and stabilizing dunes. In the afternoon session, Laing's analysis of grass morphology, William Martin's quantitative analysis of environmental gradients (for example, salinity and moisture), William Gillis' experimentation on seeds and seedlings, and the discussion by Jerry Olson and Howard Odum of the mathematical budget of sand, of plant and animal populations, and of soil nutrient elements revealed complementary approaches toward "Understanding of dune communities."

Historical comments by Charles Olmstead, president of the Ecological Society of America, recalled the early leadership in such intensive studies of George Damon Fuller, whose 91st birthday (26 January) was honored by the symposium and by a reception in the University of Chicago's department of botany. The recurring theme relating physiography and ecology also commemorated the 60th anniversary of Henry Chandler Cowles' classic dissertation on the world-famous Lake Michigan dunes. An informal evening meeting at the University of Chicago expressed unanimous concern for the historic, educational, and scientific importance of preserving these dunes in a proposed Indiana Sand Dunes National Monument and also of preserving a larger area of spectacular Oregon dunes as one of the proposed national seashore parks.

The urgent need for conservation of areas for scientific research and education was reiterated on a field trip taken by 20 of those who attended the Chicago AAAS meeting. On 31 December they visited portions of the proposed Indiana Dunes National Monument site which are being bulldozed in spite of protests by Senator Douglas and Senators Gruening and Moss that this destruction should be delayed pending action on their respective bills currently under consideration by Congress. Members of the Save-The-Dunes Council attributed the bulldozing to efforts of local speculators to make partially true their claim that the natural value of the dunes has been destroyed by industry—a claim which was cited in hearings last spring but clearly refuted by visiting senators of the Committee on Interior and Insular Affairs, by several regional and national scientific field trips last summer, and by the AAAS visitors.

AAAS members were told that the prolonged and much-criticized lobbying for public funds for a dunes harbor for private industry was currently being scrutinized by the U.S. Army Engineers. Since engineers long ago indicated technical advantages for harbor and industrial development outside this dune area, public objection to the harbor speculation as well as to the destruction of parts of the monument site should get a fair hearing by the Army Engineers as well as by the Senate committee.

JERRY S. OLSON,
Program Chairman

National Association of Biology Teachers (FG9)

The 1959 convention and program was highly successful and well received. Attendance at sessions averaged 170, the largest to date. The program on space medicine, highlighted by Dietrich E. Beischer's presentation on the Jupiter bioflight program, included films of successful space tests with animals by the United States and the U.S.S.R. The session on streamlining biology, which featured papers on the block of time idea in instruction, the AIBS film series, and advanced placement in biology, was well received. The sessions on planning biology teaching facilities and methods in teaching senior high-school likewise proved popular. Paul F. Brandwein's lecture on tactics and strategy in dealing with the gifted students in biology attracted an overflow audience. The address of Herman J. Muller, who spoke on life forms to be expected elsewhere than on the earth, and the presidential address of Paul Klinge, who spoke on biology's bright future, received standing ovations.

Membership has grown to more than 4500, and recent increases in dues will make it possible to undertake more ambitious projects and offer increased services to members. Publication of special editions of the journal has been approved. The board of directors also voluntarily doubled its financial support of AIBS. The board was unanimous in its desire to see high-school biology retained in the 10th grade, with provisions made for advanced placement.

Brother G. Nicholas of Notre Dame was commended for his excellent service on the Cooperative Committee on the Teaching of Science and Mathematics. He is succeeded by H. Seymour Fowler of Pennsylvania State University. Brother Charles of Saint Mary's College was appointed to replace George Jeffers on the AAAS Council.

Memorial resolutions were read on behalf of Dr. Harvey Stork and Dr. Richard Armacost. They will be honored in the *American Biology Teacher*.

The new officers for 1960 are: Howard E. Weaver (University of Illinois), president; Paul V. Webster (Bryan, Ohio), president elect; Philip R. Forgyce (Oak Park, Ill.), 1st vice president; Phyllis Busch (Brooklyn, N.Y.), 2nd vice president; Herman C. Kranz (Temple University), secretary-treasurer; and Joan Hunter (Aurora, Ill.), recording secretary.

HOWARD E. WEAVER, *President*

Nature Conservancy: National Committee for Natural Areas for Schools (FG10)

The work of the National Committee for Natural Areas for Schools during the past year was briefly reviewed. There are 30 members, in 25 states, with varying programs. A survey of educational use of school grounds has been or is being actively carried on in five states by means of a questionnaire distributed through school administrators, and the survey is being pushed in other states as fast as possible. This device is locating exemplary schools to be held up for others to emulate and is calling to the attention of school administrators the need for outdoor science laboratories and control areas.

Publications written wholly or in part by committee members in 1959 include: *Natural Areas for Schools*, by Verna Johnston (State Department of Natural Resources, Sacramento, Calif.); *The Site for the New School* (Nature Conservancy Bulletin 26 revised), *Checklist of Educational Environments*, and *Indoor Equipment for Outdoor Education*, by J. Brainerd; and *Manual for Outdoor Laboratories*, prepared by the National Association of Biology Teachers in cooperation with Nature Conservancy (Interstate, Danville, Ill.).

Printed material or consultation was provided schools in several states, and articles were written or lectures given for various other organizations.

New business discussed included the following suggestions: (i) that a steering group be appointed within the committee to assist the chairman; (ii) that colored slides with tape recordings should be updated and promoted; (iii) that increased attention be given to college and university natural areas for scientific research and instruction of teachers; (iv) that cooperating organizations in the AAAS be urged to promote the theme of Natural Areas for Schools at the New York meeting in 1960; (v) that more articles be submitted to journals.

JOHN BRAINERD, *Chairman*

Botanical Sciences (Section G)

Sessions sponsored by Section G at the Chicago meeting were few in number but uniformly successful. The fifth annual session of the continuing symposium on "Unsolved Problems in Biology" marked a new high point in interest and attendance. The symposium,

jointly sponsored by Sections F and G, was held in two sessions. The presentations elicited considerable interest on the part of the audience, which completely filled the room at all times. In fact, the occasion was marred only by the inability of the room to accommodate all those who were interested in attending this symposium.

This year's Botanists' Dinner was an unusual occasion in that it combined the dinner of the American Society of Plant Taxonomists with that of Section G. The occasion was marked by the presentation of two absorbing talks by W. C. Steere, retiring president of the ASPT and F. W. Went, retiring chairman of Section G. By all signs the botanical program at Chicago appears to have been a success.

BARRY COMMONER, *Secretary*

American Society of Plant Taxonomists (G1)

The American Society of Plant Taxonomists held its 1959 annual meeting 28-29 December in Chicago with Section G of the AAAS. In addition to two sessions of contributed papers, the society held its annual business meeting and a dinner meeting. There was also a brief meeting of the ASPT council. Officers of the society for 1960 were announced as follows: Lyman Benson (Pomona College), president; C. Ritchie Bell (University of North Carolina), secretary; Richard W. Pohl (Iowa State University), treasurer; Mildred E. Mathias (U.C.L.A.), chairman of the council; Charles B. Heiser (Indiana University), new council member; David D. Keck (National Science Foundation), retiring council member.

A paper entitled "Cytological evidence on the relationship of *Krigia* and *Serinia*," by Kenton L. Chambers, of Yale University, received the ASPT Cooley Award of \$100 for the best taxonomy paper presented at the annual meeting of the society. A paper by Julian A. Miller, J. E. Giddens, and A. A. Foster, "A survey of the fungi of forest and cultivated soils of Georgia" [*Mycologia* 49, 779 (Nov.-Dec. 1957), but actually published in March 1958], was selected for the ASPT \$500 Cooley Award for the best taxonomic paper, concerning southeastern plants, published in 1958.

The 1960 ASPT meeting will be held in August, with the American Institute of Biological Sciences, at Oklahoma State University.

C. RITCHIE BELL, *Secretary*

Anthropology (Section H)

The 3-day presentation of Section H consisted of two sessions of contributed papers ranging from ethnological theory to linguistics, and four sessions of symposia on archeological advances and new technological aids.

A symposium on biology and history in their contributions to archeology, arranged by John C. McGregor, included specific applications of studies of freshwater mollusks and food plants to archeological chronology and cultural interpretation, together with more general papers on tree-ring dating, special areas of zoological research, and the methods of history as adjuncts of archeology. In his opening address, as chairman of the section, McGregor treated North American archeology in view of its latest accomplishments and expressed concern about the future of salvage archeology, as it becomes more extensive and urgent, in keeping pace with various earth-moving agencies.

A remarkable three-session symposium on technology as a backstop to anthropology and archeology, arranged and closely integrated by Ray Winfield Smith, brought together scientists who are currently developing techniques in various fields with a view to learning of special new archeological and museum applications. Among the techniques reported as already applicable, or nearly so, were those of trace-element geochemistry, neutron beam and other microscopy, x-ray spectroscopy, and thermoluminescence. The latest advances in radiocarbon analysis were reviewed. Studies of art objects by electron microbeam probe and other methods were defined and discussed by several of the participants. Papers on the progress of archeological technology in the Boston Museum of Fine Arts and in the Research Laboratory for Archaeology and the History of Art, Oxford University, suggest a more scientific future for large museums of the world.

J. L. GIDDINGS, *Secretary*

Psychology (Section I)

The program at Chicago, like that of recent years, consisted of a vice presidential address and several symposia on research of current interest. Frank A. Geldard (University of Virginia) delivered the vice presidential address on "Some neglected possibilities of com-

munications." Four of the symposium sessions were arranged by the American Psychiatric Association but were cosponsored by Section I. Their general subject was Roots of Behavior; specific topics were "Genetics of behavior," "Early experience," "Instinctual behavior," and "Free-ranging behavior of primates and nonprimates." In addition, Section I presented symposia on "Verbal learning and meaningfulness," "Unconscious processes," and "Brain function and learning." The section plans a similar kind of program, but on different topics, at the New York meeting in 1960. The vice president for 1960 is C. T. Morgan (University of Wisconsin). Frank W. Finger (University of Virginia) was appointed to a 4-year term (1960-63) as the new secretary of the section.

CLIFFORD T. MORGAN,
Retiring Secretary

Social and Economic Sciences (Section K)

Section K again enjoyed the cooperation of its principal behavioral science organizations which are section affiliates, the American Economic Association, the American Political Science Association, the American Sociological Association, and the American Statistical Association.

The American Economic Association, together with the National Institute of Social and Behavioral Science and the Population Association of America, cosponsored the symposium on World Population and International Relations, which included the outstanding vice presidential address for the section by Philip M. Hauser (University of Chicago). William S. Vickrey (Columbia University) presided on behalf of the American Economic Association. The session had an attendance of over 200 social and natural scientists.

The American Political Science Association held a session for invited papers on the subject of "Scientific knowledge and public policy-making." Papers were presented by Richard L. Meier (University of Michigan), H. Burr Steinbach (University of Chicago), and Eugene Rabinowitch (University of Illinois). Discussants were Marbury B. Ogle (Purdue University), Duncan MacRae (University of Chicago), and Harold D. Lasswell (Yale University). James A. Robinson (Northwestern University), who arranged the program, presided.

The American Sociological Association held two symposia at the Chicago meeting. The first was on the Use of Computers in Simulation of Social Behavior, arranged by James S. Coleman (Johns Hopkins University), who presided. The second was on Trends in Family Formation and Structure; Irene B. Taeuber (Princeton University) arranged the program and presided. These symposia attained a high degree of professional excellence and were especially contributive to their respective subjects.

The American Statistical Association also held a program of two-session symposia, one on Descriptive Statistics and the other on Statistical Techniques. The papers given and the comments of the discussants of both sessions provided a penetrating and incisive course of intellectual fare for the subjects under review. For this achievement, the participants and Robert F. Winch (Northwestern University), who arranged the program and served as presiding officer, deserve much credit.

The American Society of Criminology held four general sessions under the general program chairmanship of Donald E. J. MacNamara (New York Institute of Criminology). The society also held two luncheons, one of which was an award luncheon for the Most Reverend Bernard J. Sheil, auxiliary bishop of Chicago.

A round table discussion on "Converting to metrics in the pharmaceutical industry" was held by the Metric Association. Discussants were J. T. Johnson (Metric Association), Fred J. Helgren (Metric Association), L. A. Feiertag (Abbott Laboratories), and Harry E. Sagen (Abbott Laboratories).

A session of invited papers, "The underdeveloped areas," was held by the National Academy of Economics and Political Science. Participants were Philip M. Hauser (University of Chicago) and Sidney C. Sufrin (Syracuse University). Amos E. Taylor (Pan American Union) presided.

Two sessions for contributed papers concluded the general Section K program. Very contributive presentations in all behavioral fields were offered by Erwin L. Linn (National Institutes of Health), Nathaniel S. Lehrman (Albert Einstein College of Medicine), Richard C. Bernhard (University of California), Reuben E. Slesinger (University of Pittsburgh), Stoyan Gavrilovic (Dickinson College), Simon Rottenberg (University of Chicago), James C. Scurlock (Foundation for Normal Accounting), Latheef

N. Ahmed (Howard University), Peter R. Senn (Wright Junior College), and John T. Blue (Virginia State College). Donald P. Ray, secretary of Section K, presided.

Section K served as cosponsor of the above described sessions of the American Economic Association, the American Political Science Association, the American Sociological Association, and the American Statistical Association, and also as cosponsor of the four-session symposium of Section N—Medical Sciences, on Aging.

The section committee and the officers of Section K appreciate deeply the assistance and efforts of all those whose contributions enabled the Chicago programs to achieve outstanding success. It is gratifying to note an increasing interest in the activities of the section, not only on the part of social scientists but also on the part of natural scientists.

Section K was fortunate to have the leadership during 1959 of the distinguished demographer and sociologist Philip M. Hauser (University of Chicago). This year the equally distinguished political and social scientist Pendleton Herring (Social Science Research Council) will serve as chairman, and the eminent economist, Kenneth E. Boulding (University of Michigan), will begin a 4-year term of service as a member-at-large of the Section Committee.

DONALD P. RAY, *Secretary*

American Political Science Association (K2)

The American Political Science Association panel discussed "Scientific knowledge and public policy-making." H. Burr Steinbach (chairman of the department of zoology at the University of Chicago) emphasized the nonspecialist roles of scientists and discussed various normative proposals for making science more readily available to policymakers. He emphatically opposed creation of a department of science in the national government. Eugene Rabinowitch (research professor of biophysics at the University of Illinois) reported on recent trends among scientists for injecting knowledge of crucial scientific developments into governmental decision processes. He referred especially to matters relating to nuclear power and international relations. Richard L. Meier (Mental Health Research Institute, University of Michigan, and department of city and regional planning, Harvard University) presented a model

of advice-giving roles applicable to scientists and others in governmental decision-making and discussed the relative merits of a recent proposal for a Science Service (correspondent with the Public Health Service) and an alternative for developing information- and decision-theorists who would be middlemen between producers and consumers of knowledge.

The discussion of these papers was led by three political scientists noted for interdisciplinary work. Marbury B. Ogle, Jr. (chairman of the department of history and political science, Purdue University), pointed out that the absence of a common value pattern among scientists, as among other elements of the population, leads to policy differences even among those who agree upon the "facts." He suggested that discussions of this sort should also note the importance of political-legislative sources for influence as well as those in the executive branch. Duncan MacRae, Jr. (political sociologist, University of Chicago), drew upon political science research to suggest that scientific knowledge might be brought to bear on the policy process indirectly through the education of elites and "attentive publics." He noted the difficulty in encouraging scientists to hold elective office in view of the uncertainty of such positions and the risks of losing pace in rapidly changing scientific professions.

Harold Lasswell (Law School and political science department, Yale University) argued for developing more effective means of presenting images of the future which are required if policy is to plan for future contingencies. He urged physical and natural scientists to join social scientists in clarifying societal goals. While Lasswell was more optimistic about the rate of penetration of scientific knowledge into the policy process, he joined others in urging consideration of how penetration might be expedited.

No consensus was found on means of improving the relation of science to policy, and there was general agreement that research on the roles of science in policy processes is lacking.

JAMES A. ROBINSON, *Program Chairman*

American Society of Criminology (K3)

Papers presented at the sessions of the American Society of Criminology emphasized that psychiatry has contributed tremendously to the formulation of criminological theory and the devel-

opment of crime-study techniques (Karl Menninger); that smaller case-loads and intensified supervision by specially selected and trained parole officers dramatically reduced the incidence of recidivism among New York state parolees over a 3-year span (Meyer Diskind); that the charge leveled against the Puerto Rican population of New York's metropolitan area that they contribute disproportionately to the city's crime rate is inaccurate, growing out of a manipulation and distortion of crime statistics by prejudiced and intolerant observers and is similar to the hate campaigns directed against the Irish, Italians, and other immigrant groups in past decades (Donal E. J. McNamara); that interrogation under hypnosis and narcosis is feasible, can overcome inhibitions and memory blocks, and when carried on by qualified and ethical practitioners in a nonpunitive setting can contribute to the true administration of justice (Ralph Banay); that the exchange of police officers between countries under the ICA program has immeasurably strengthened law enforcement and has contributed solidly to its professionalization (Russell Snook); that chemical tests for intoxication are well accepted as basic to a sound drunk-driving control program (Oliver Schroeder, Jr.); that overspecialization, proliferation of police units, and duplication of responsibility and jurisdiction are recurrent organizational problems in many police departments (George Eastman); that the dissemination of obscene and pornographic materials among teen-agers is a factor in delinquency causation (Lois Higgins); that the gravitation of power into the hands of the unintelligent, immoral, and irresponsible gives new support and importance to Lord Acton's thesis (Walter Lunden); that deprivation of normal sex life is one of the basic problems in penology, leading to sex perversions, attempted escapes, and institutional tensions—Mississippi has attempted to meet this problem by authorizing conjugal visits, other prison systems by furloughs to prisoners who behave well, still others by the family picnic system, but the vast majority of American prison systems still stick to sex repression (Clyde Vedder); that the study of police in historical perspective can cast new light on solutions to current police and crime problems (David Monroe); that the Social Defense Section of the United Nations is engaged in continual studies of crime and cognate phenomena and in the reporting of comparative crime statistics (Manuel

Lopez-Rey); that there have been marked increases in both the illegitimate birth rates and venereal disease rates among American teen-agers during the past five years, indicating increases in casual sexual promiscuity at the junior and senior high school levels, probably due to more permissive or tolerant attitudes among parents and teachers, less emphasis on moral restraints, exaggeration of the efficacy of the penicillin treatment program, and failure of society to understand the adolescent need for affection, example, instruction, control, and discipline (Donal E. J. McNamara); that police, probation, parole, and institutional personnel must be given opportunities to observe, experience, and understand the objectives and problems with which each is concerned (William Melnicoe); that the therapist must be able to recognize conduct patterns which are irreversible (Jacob Chwast); that the study of the individual offender is basic to an understanding of criminal phenomena (Arthur Belley); that the development of training programs in criminology, particularly at the college and university level in the United States, has followed no coherent pattern and discloses little evidence of an integrated philosophy of crime control (Peter Legins); that parole of convicted felons to the military services in time of great manpower need (for example, in World War II) creates problems but can be accomplished with some degree of success (Hans Mattick); that the controversy between those who advocate a punitive, repressive, law enforcement approach to the narcotics problem and those who support some variety of public-health-oriented control system is unresolved because the disputants on both sides approach the problem emotionally rather than scientifically and from divergent basic premises—in the discussion there was no agreement on the definitions, statistics, objectives, and accomplishments of either school, and the spirited debate about the existence or nonexistence of the so-called "English system" of control indicates a need for more observation, objective analysis, and solid reporting of factual data before public discussion of conclusions and opinions.

The society elected the following officers for 1960: Marcel Frym, Hacker Psychiatric Foundation, president; Morris Caldwell, University of Alabama, Canio Zarrilli, New York Institute of Criminology, William Dienststein, Fresno State College, and Don L. Kookan, Indiana University, vice presidents; Donal

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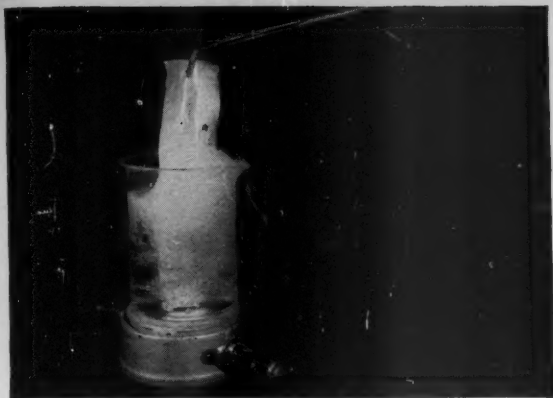
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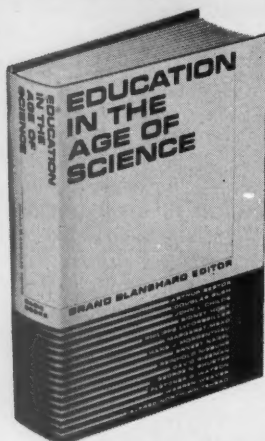
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E. J. MacNamara, New York Institute of Criminology, secretary-treasurer and AAAS Representative; Vernon Fox, Florida State University, member-at-large; and Howard Leary, deputy police commissioner of Philadelphia, editor.

The 1959 Annual Award of the American Society of Criminology was presented to the Most Reverend Bernard J. Sheil, D.D. Telegrams and letters congratulating Dr. Sheil were received from President Eisenhower, Vice President Nixon, Adlai Stevenson, Harry Truman, Eleanor Roosevelt, and several score criminologists and criminological organizations.

DONAL E. J. MACNAMARA,
Secretary-Treasurer

American Statistical Association (K5)

The American Statistical Association held two symposia, one on descriptive statistics and one on statistical techniques. The papers on descriptive statistics were concerned with the population statistics of the Ch'ing dynasty of China (Irene B. Taeuber and Nai-Chai Wang); an analysis, based on census data, of marital instability and its relation to education, income, and occupation (Karen G. Hillman); voting in Illinois from 1888 to 1958 (Duncan MacRae, Jr., and James A. Meldrum); and the estimation and use of production functions in agriculture (Earl O. Heady and Luther Tweeten).

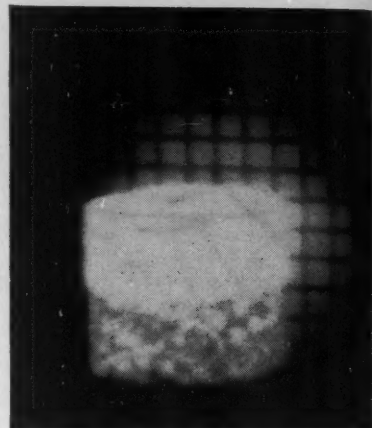
In the second symposium, the following statistical techniques were discussed: "Beyond factor analysis" (R. Darrell Bock); the use of forced choice questions and the power function (Robert McGinnis); the repeated measurements problem (John W. Cotton); and a comprehensive model for reliability theory (Lee J. Cronbach and Goldine C. Gleser).

ROBERT F. WINCH, Program Chairman

History and Philosophy of Science (Section L)

I am delighted to report that the sessions of Section L were outstandingly successful. Many enthusiastic congratulations reached me during and after the Chicago meeting. Encouraged by Raymond L. Taylor's helpful and suggestive ideas on "Symposia in utopia" [*Science* 123, 253 (17 Feb. 1956)] I had organized a 4-day conference consisting of two symposia on Theory Construction in Logical and Historical Perspectives and one symposium on each of

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the following topics: Law and Convention in Physical Theory; Induction, Probability, and Simplicity; The Logic of Constants and Variables; Philosophical Issues of Quantum Theory; and Methodological Problems of Psychology and the Social Sciences.

I am deeply grateful to all the participants for their splendid contributions. The meetings were extremely well attended. The size of the audience varied from about 50 to over 200. The Lincoln-Douglas room of the LaSalle Hotel, in which all our sessions were held, was filled nearly to capacity at the symposia on quantum theory and probability and on the occasion of my vice-presidential address. The enthusiasm of the audience was impressive. On Tuesday, 29 December, morning, afternoon, and evening sessions were held, all well attended, with long and intensive discussions, also from the floor. Most remarkable in this respect was the symposium on the philosophy of quantum theory. An audience of 200 people listened with rapt attention (and participated) in this session which lasted without interruption for 4 hours. I don't think that there were more than three or four people who left the room during the symposium.

I wish it were possible in this all-too-brief report to summarize at least the highlights of the conference. But practically *all* speeches were of extraordinarily high quality, and space permits me to say only that a great number of the scientists and philosophers present in the audience told me that they had never witnessed a more "meaty and exciting" conference. Philosophy and history of science are now fully recognized in their important and indispensable role in the world of scholarship. The logic and methodology of the sciences, based on an adequate grasp of the crucial junctures in the history of scientific ideas, devoted to an analysis of the basic concepts, assumptions, and procedures of the sciences, were well reflected (even though only in a few areas of concentration) in the symposia held at the meeting.

It was very difficult to choose from the excellent set of lectures those papers which should be submitted for the Newcomb-Cleveland prize. Upon consultation with several of my most experienced colleagues I decided to submit six papers, each superb in its own way, as candidates for this honor.

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intention to publish not only the main papers, but also those of the discussants as well as the rejoinders by the authors of the initial papers. In some cases even brief discussions from the audience will probably be included in the volume (to be edited by the Minnesota Center for Philosophy of Science).

Since the History of Science Association held its meetings simultaneously and in a different place, it is a matter of regret that there was only a very limited interchange between the two groups during the Chicago meeting. As currently planned, this defect will be remedied in the program of Section L in the New York meeting in 1960. The history of science will loom large in that program, and philosophy of science, having had such a full and rich representation at the Chicago meeting, will plan only for a smaller part of the New York sessions. In view of the interest in interdisciplinary communication, emphasized at the luncheon of the officers of the AAAS, I have suggested a symposium on comparative methodology of the sciences for New York 1960.

I wish to express my sincerest thanks to the officers of the AAAS, especially to R. L. Taylor, Mr. Streeter (secretary of Section L), and to the participants in the Chicago symposia on philosophy and history of science for their splendid cooperation which helped make our meeting one of such uniquely superb quality.

HERBERT FEIGL, *Chairman*

Philosophy of Science Association (L2)

William Alberts (University of Chicago) read a paper concerning the theory of "the public interest." The paper was criticized by Lewis Zerby (Michigan State) and Wayne Leys (Roosevelt) and provoked a lively discussion in which various members of the audience participated.

Most of the participants were inclined to the view that "the public interest" is a concept with theoretical significance, despite the fact that the words are often used for propagandistic purposes. To this extent there was disagreement with the conclusions reached by several political scientists in recent studies.

The issue that divided the symposiasts was the question whether "the public interest" should be conceived as an aggregate of interests or as the outcome of decision-making institutions when proper procedures are followed.

This was the issue that had been defined by Leys and Perry in the investigation which they conducted last year for a committee of the American Philosophical Association.

Alberts took the "proceduralist" position, although he recognized several difficulties in this conception of "the public interest": (i) it undermines our faith that scientific knowledge can be used in any direct or simple fashion to determine "the public interest," since social problems (controversies regarding the public interest) cannot be viewed as the finding of efficient means for achieving common goals; (ii) it does not easily explain the consensus that seems to exist in a free society even when the decision-making procedures themselves are in dispute. Alberts suggested that this consensus is an agreement about the relevance of values, underlying debates over particular combinations of values to be realized by public policy.

Zerby and several speakers from the floor ably defended the "aggregationist" position, but their arguments cannot be included in the space allowed for this report.

WAYNE A. R. LEYS, *Program Chairman*

Medical Sciences (Section N)

Section N held its annual symposium organized along the conventional patterns of an interdisciplinary approach to a discussion of a subject of current interest and importance in the medical field. The subject for the symposium this year was Aging—Facts and Theories; the symposium was divided into four half-day sessions.

The first speaker, John W. McConnell (New York State School of Industrial and Labor Relations at Cornell University) emphasized the complexity of the economic problems arising from efforts to provide adequately for the aging population. He emphasized that a large portion of people over 65 do not have economic stability and that their total annual income is at a level which provides no more than the basic necessities of life. Moreover, the very real and important effect that inflation has upon the operation of the economy as a whole is reflected to a greater degree on incomes dependent upon current fixed pension systems.

Joseph T. Freeman (Philadelphia) reviewed the diseases of the aged and pointed out that although diseases of the young are also seen among the

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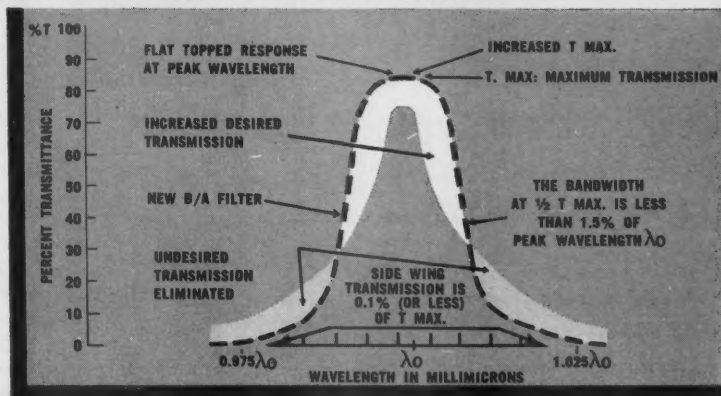
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aged, there are such diseases as osteoporosis, heart disease, cancer, and others which are found with much higher frequency in the older age group. He emphasized particularly the importance of the physician as a biologist in studying the aging problem, as aging is a phenomenon of all biological species; by studying aging in various species, answers to fundamental problems may be found. Robert J. Havighurst (University of Chicago) discussed the problems of work and retirement, emphasizing the importance of preparing psychologically for the retirement period. He also emphasized that a change in our retirement program should be permissible to allow

the individual who is capable of working beyond a mandatory retirement age to do so. James Ebert (Carnegie Institution of Washington) discussed the very beautiful studies which have been performed with Rous sarcoma virus grown on chick chorioallantoic membrane mixed with crude fresh muscle extract derived from the adult chicken or 18-day-old embryo. He was able to show that, when the isolated Rous sarcoma microsomes and heart microsomes are applied in combination to the developing chick embryo, growths are produced on the chorioallantoic membranes which contain striations similar in character to those in cardiac tissue.

Abraham White (Albert Einstein College of Medicine) employed the method of studying the balance between anabolic and catabolic phenomena. He was able to show very beautifully that the influence of a hormone may be in opposite directions, depending upon the age of the host from which the particular tissue is taken.

Milton Landowne (Levindale Hebrew Home, Baltimore, Md.) stressed the importance of the changing nature of connective tissue ground substance accompanying the aging process. He discussed in particular those changes related to the cardiovascular system.

Gregory Pincus (Worcester Foundation for Experimental Biology) reviewed the current status of the steroid hormones in the aging of man, pointing out such observations as the increased somatotropic hormones in postmenopausal women and of men of increasing age.

Bentley Glass (Johns Hopkins), in discussing the relationship of genetics to the aging process, very masterfully reviewed the theories of aging, indicating their weaknesses and strengths. He indicated that such significant contributions as those of Strehler, for example, contribute toward positive thinking in this field.

In the fourth and final session of the symposium consideration was given to the current facts relating to aging, and some of the theories which will, hopefully, offer a guide for future investigation. Nathan W. Shock (vice president of Section N) discussed in some detail the physiological changes which accompany the aging process. He emphasized in particular, those functions which decrease during the development of senescence and pointed out that these functions do not all decrease to the same extent. For example, changes in the heart and kidney are much greater than functional changes in the nervous system and enzyme activity of tissue. He presented evidence which indicated that performance associated with advancing age in human beings is due to three factors: (i) the dropping out of functional units in key systems; (ii) impairment in the functional capacity of the cells remaining; and (iii) the breakdown of integrated function in the individual.

Prioreschi (University of Montreal) discussed a stress theory of aging, arguing that the rate at which the initial amount of "adaptive energy" present at birth is finally expended contributes to the length of life of a species.

The symposium was closed by Samuel



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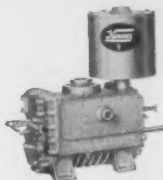
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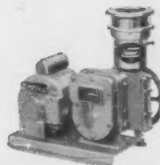
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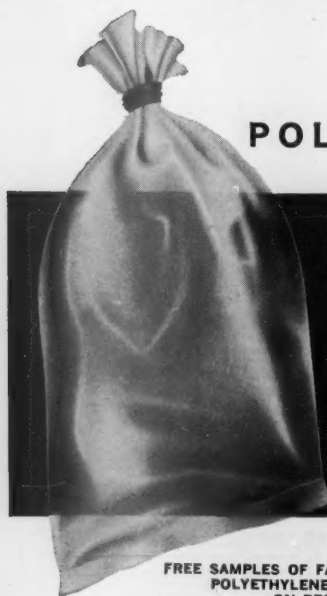
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E. Stumpf (Vanderbilt University) who entitled his discourse "The expanding new world of second-story people." He raised very interesting and provocative questions concerning the reasons for maintaining the aged, and the factors which have led to an increase in this so-called second-story, or postretirement population. He emphasized the necessity for maintaining in the aged the feeling of status, dignity, prestige, authority, and pleasure, which so frequently are significantly modified when the individual comes to the age of his retirement.

When viewing the status of current research in this field, it is clearly evident that solutions to problems of the aged, from a sociological, economic, and biological point of view are in their infancy. The reasons for aging are at the present time not clearly understood. It can be anticipated that the critical testing of the theories presented may give new clues to the reasons for senescence. Investigators reporting at this symposium are clearly to be congratulated on their adventurous approaches into this very important and complicated area of biological and sociological interest. (This symposium was in part supported by grant RG-6789 from the National Institutes of Health.)

ALLAN D. BASS, *Secretary*

Dentistry (Section Nd)

Section Nd held two symposia at the Chicago meeting arranged under the direction of the program chairman, Frank Orland (University of Chicago).

The first symposium, on the oral aspects of aging, with R. F. Sognnaes as moderator, covered various levels of observations from gross morphology to ultrastructure with the following subtopics:

S. Pruzansky (University of Illinois) reported on aging of the face as observed by means of cephalometry of the craniofacial growth pattern, with special reference to the syndrome of progeria in which the affected child resembles a very aged person.

E. O. Butcher and J. Klingsberg (New York University) reported on histological aging changes in the supporting tissues of the teeth in rats, hamsters, and monkeys of different age groups, and noted various differences in the susceptibility of these animals to gingival inflammation versus alveolar bone destruction.

J. R. Ring (Washington University) applied histochemical techniques to the

study of subepithelial connective tissue of the mouth, noting age changes which may be responsible for an impeded interchange of body fluids and the connective tissue cells.

A. A. Dahlberg (University of Chicago) presented a comparison from an anthropological point of view of the aging pattern in teeth from different population groups, noting variations in physiological response, wear and tear, in the aging pattern from group to group.

John Nalbandian and R. F. Sognnaes (Harvard) discussed the microstructural age changes in teeth of contemporary man, focusing primarily on the micro-radiographic and electronmicroscopic nature of dentin in connection with the increasing sclerosis of the root dentin with age.

David Weisberger (Harvard), in absentia, projected certain areas of oral age manifestations warranting further study in the future.

The second symposium arranged by Section Nd represented the final commemorating event of the 100th anniversary of the American Dental Association entitled "American Dentistry at the Centennial Crossroad."

G. C. Paffenbarger (National Bureau of Standards) reviewed the development and application of the varied types of dental materials employed in restorative dentistry over the past 100 years.

H. Trendley Dean (American Dental Association) discussed the use of the epidemiological method in dental research, illustrating its importance by reviewing the development of water fluoridation as a public health measure.

R. M. Stephan (National Institute of Dental Research) illustrated the antiquity of many so-called "modern" ideas and emphasized the need for making quickly available to investigators the latest world-wide research information.

S. Peterson (American Dental Association) reviewed the importance of dental education in the growth of dentistry as a profession, stressing the recent rapid extension of graduate and postgraduate studies, hospital internships, and residencies.

L. W. Morrey and N. C. Hudson (American Dental Association) presented a complete review of the periodical literature from the time of the publication of the first *American Journal of Dental Science* in 1839, up till 1958 when 173 dental publications were issued in the United States, versus 192 dental journals in 49 other countries.

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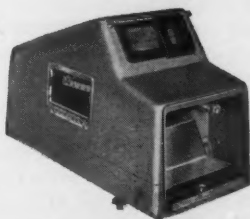
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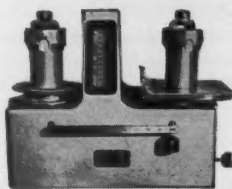
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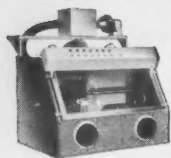
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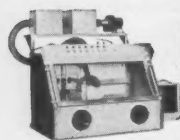




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B. S. Hollinshead (director, Survey of Dentistry) discussed certain philosophical problems of dentistry in its 100th year, including the relation between the profession and the public and the role of dental education and research in the progress of dentistry.

At the conclusion of these two formal scientific gatherings of Section Nd, resolutions were made on the death during 1959 of two distinguished contributors to dental science: Dr. Edward Hatton, past president and for many years secretary-treasurer of the International Association for Dental Research; and Dr. Frederick McKay, pioneer in the epidemiological research on mottled enamel which led to the use of fluoridation as a public health measure.

At the conclusion of the meetings, Paul Jeserich (University of Michigan), president of the American Dental Association, addressed a concluding luncheon meeting of Section Nd, emphasizing the need for coordinated efforts among the dental groups representing practitioners, educators, and research workers.

In addition to its own program, Section Nd cosponsored three other programs: the large symposium on aging arranged by Section N (Medicine); the extensive symposium on germ plasm resources in agriculture arranged by Section O (Agriculture); and the annual meeting of Alpha Epsilon Delta, national premedical honor society, which arranged a symposium on premedical and pre-dental education. At the latter, L. R. Gribble, national president of Alpha Epsilon Delta, presided, and I. Schour, dean of the University of Illinois College of Dentistry, gave the welcoming remarks. The first two papers reviewed the usefulness and pitfalls of aptitude tests as predictions for success in medical and dental schools, C. F. Schumacher discussing the MCAT and Grace Parkin discussing the ADA aptitude test. The third speaker reviewed the recent Frank Bane report (U.S.P.H. Publ. No. 709) emphasizing the greater need for medical and dental practitioners at present and in the future, and the financial predicament of professional students. This part of the meeting was followed by panel discussions centering around the qualifications of students and specific approaches used by certain schools to select students. A luncheon meeting followed, during which H. E. Longenecker (University of Illinois) spoke on applicants in future years.

At the concluding Council meeting of the AAAS was announced the election

of two new officers of Section Nd: for vice president and chairman, 1960, Joseph L. T. Appleton, professor emeritus and former dean, School of Dentistry, University of Pennsylvania; for councillor-at-large, 1960-63, John Hein, dean, Tufts University School of Dental Medicine.

REIDAR F. SOGNAES, *Secretary*

Pharmacy (Section Np)

Section Np held eight sessions in Chicago. Forty-eight contributed papers on various studies were presented, and one symposium was held. Over 300 persons registered as having attended one or more of the section meetings.

The AAAS Council, the governing body of the Association, elected Joseph Swintosky (Research Division, Smith, Kline and French Laboratories) as a vice president of the Association and Don E. Francke (University Hospital, University of Michigan) to serve on the committee-at-large of the section for a 4-year term. Swintosky will serve as chairman of the section for the coming year.

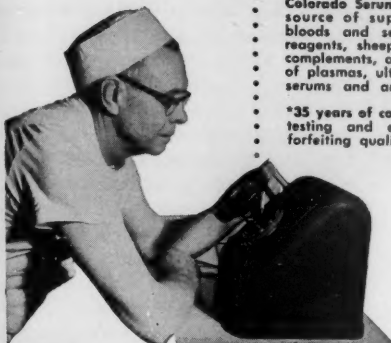
Of major interest to the group in attendance was a most stimulating vice-presidential address on "Professionalism and the pharmaceutical scientist" presented by Glenn L. Jenkins. A symposium entitled "The Scientist's Part in Protection of the Public, Part I: Food, Drug, Cosmetic and Hazardous Chemical Problems; Part II: Food Additive Legislation" also attracted considerable interest, not only on the part of the pharmaceutical scientists in attendance, but also by many individuals from other scientific disciplines. Joseph Swintosky and Glenn L. Jenkins gave introductory remarks and served as presiding officers. Bernard E. Conley (secretary of the Committee on Toxicology of the American Medical Association) gave a discussion of the labeling of hazardous chemicals. William F. Bousquet (Purdue University) presented the problems of legislation on pharmaceutical ingredients and approaches to solving them. Bousquet emphasized the importance of radioisotope techniques in studying food and drug residues and formed metabolites. The role of the cosmetic scientist in protecting the public health was covered by Raymond E. Reed (Toni Company). John H. Rust (University of Chicago) spoke on the applications of radioactive isotope tracer techniques to studying the food additive problem. He emphasized the need for edu-

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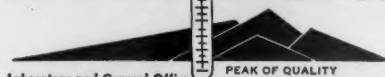
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Occupation.....

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Is car principally kept and used on a farm or ranch?

Yr.	Make	Model (Dlx., etc.)	Cyl.	Body Style	Purchase Date	<input type="checkbox"/> New
					Mo. Yr.	<input type="checkbox"/> Used

1. (a) Days per week car driven to work?..... One way distance is.....miles.
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cation in isotope tracer techniques to supply trained personnel for food research now necessary under present food additive legislation. Problems in evaluating the safety of intentional food additives and unintentional food additives were set forth by O. Garth Fitzhugh and Arnold J. Lehman (Food and Drug Administration). Edward J. Matson (Abbott Laboratories) explored the philosophical question of scientific judgement in law and regulation. He emphasized the need for sound scientific judgement based on known facts in arriving at conclusions regarding levels of toxic and carcinogenic substances in foods for human consumption. The role of the scientific expert under recent food laws was summarized by Bernard L. Oser (Food and Drug Research Laboratories). The symposium was terminated with a question and answer session on current food, drug, and cosmetic problems.

In addition to the above-mentioned program, the hospital pharmacy group had a most informative and well-attended full-day session under the guidance of George F. Archambault and Joseph A. Oddis. The meeting was held in the recently completed facilities of

the American Hospital Association. The following organizations were represented: American Society of Hospital Pharmacists, American Pharmaceutical Association, Illinois Society of Hospital Pharmacists, American Hospital Association, National Association of Boards of Pharmacy, U.S. Public Health Service, Illinois Hospital Association, and the National Institutes of Health. Luncheon, entertainment, and dinner were sponsored by E. R. Squibb & Sons, Mead Johnson and Company, and McKesson and Robbins, Inc., respectively.

George L. Webster (University of Illinois) opened the sessions of contributed papers. Egil Ramstad and his co-workers (Purdue University) presented a series of six papers describing work done on plant biogenesis and metabolism using radioactive tracer techniques. C. T. Peng (University of California) discussed quenching of fluorescence in liquid scintillation counting and in a second paper the fate of tumor implants in rats. The distribution of C^{14} meprobamate in rat brain was discussed by J. L. Emmerson, T. S. Miya, and G. K. W. Yim (Purdue University). Herbert Schriftman (Wyeth Laboratories) spoke of the applications of

paper chromatography and electrophoresis to the assay of pharmaceutical products. An improved 4π , whole-body liquid scintillation counter was described by B. G. Dunavant and J. E. Christian (Purdue University), and J. P. Vacik and J. E. Christian (Purdue) described the application of neutron activation analysis to the micro analysis of gold-containing pharmaceuticals. G. Levy (University of Buffalo) described the physical-chemical basis of the buffered aspirin controversy; D. E. Guttman (Ohio State University) discussed the solubilization of riboflavin; J. Autian (University of Michigan) discussed the binding of drugs by plastics; and M. L. Eichmann (Ohio State University) presented information concerning the interactions of xanthine molecules with serum albumin.

Other papers presented were "methods of synthesis of tetrahydroquinolinonium salts," "Color-coding of drug dosage forms," "Hydration of procaine base," "Evaluation of suppository bases," "The social psychology of prescription writing," "Effects of physostigmine on chick eggs," "Pharmacological prevention of acute heart failure," and "Spray-drying of tablet granulations." These papers were delivered by D. M. Stuart (Oregon State College), R. G. Brown (University of Texas), W. A. Strickland, Jr. (University of Arkansas), J. Anschel (Warner-Lambert Research Institute), E. J. W. Hall (University of Texas), V. A. Green (University of Texas), J. W. Ingalls, Jr. (Long Island University), and A. M. Raff (Smith, Kline and French Laboratories), respectively.

This meeting proved to be one of the most successful meetings of Section Np of the AAAS in recent years and was exceedingly well attended.

JOHN E. CHRISTIAN, *Secretary*

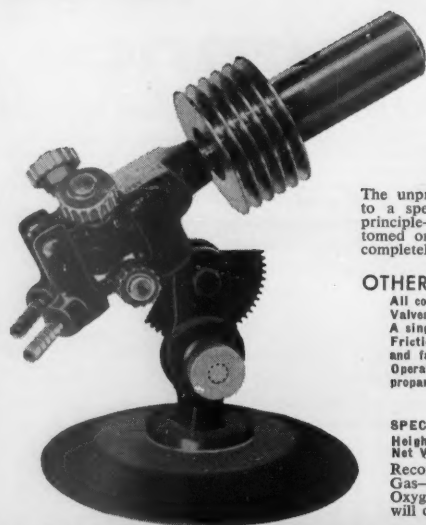
Agriculture (Section O)

The Section O program consisted of a symposium on Germ Plasm Resources in Agriculture; Development and Protection. This program was arranged by the chairman of the section, R. E. Hodgson; it was co-sponsored by AAAS sections F, G, N, and Nd, and by 15 scientific societies. Of these societies, nine are affiliated with Section O, and six are affiliated with other AAAS sections.

The symposium was arranged in five half-day sessions as follows: (i) origin of germ plasm; (ii) the need for, and

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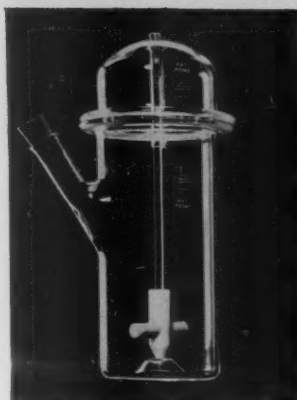
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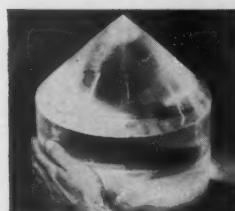
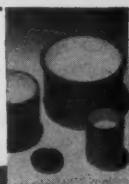
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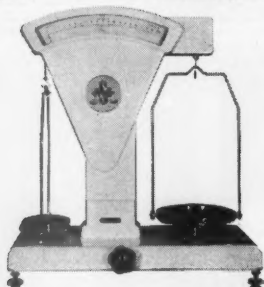
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utilization of, additional sources of germ plasm; (iii) developmental programs in crops and livestock; (iv) new approaches in the use of plant and animal germ plasm; (v) perpetuation and protection of breeding stocks. There were 26 invited papers and five discussion papers.

The entire program was very well attended, with a grand total of about 600. Interest and attendance were sustained to the very end of program, attesting to the excellence of the papers presented. The symposium topic dealt equally with plants and animals, and it accomplished the objective of providing interdisciplinary knowledge, techniques, and concepts to scientists concerned with many phases of germ plasm resources and their development and protection.

The chairman designated for Section O for 1960 is Firman E. Bear, of Rutgers University. A theme for the 1960 symposium program in New York has been selected: Rural land zoning for agriculture and forestry and for urban and industrial development. Bear will have responsibility for the development of the program. R. E. Hodgson (1959 chairman), has been elected as a committeeman-at-large for Section O, for a 4-year term.

HOWARD B. SPRAGUE, *Secretary*

Industrial Science (Section P)

The total impact of modern science on the food industry provided the central theme for Section P. In a half-day program, the present and potential future contributions of the biological, physical, social, and behavioral sciences to the food industry were assessed respectively by: Walter L. Obold (Drexel Institute of Technology), John R. Matchett (U.S. Department of Agriculture), Ross A. Kelly (University of Illinois), and Leonard Kent (Needham, Louis and Brorby, Inc.).

In introducing the symposium, Earl P. Stevenson, vice president for Section P, observed that modern technology has a practical concern for reconciling man's productive potential with his reproductive potential. While we must be mindful that the balancing of the two cannot be achieved through production alone, the realistic approach is not the control of population growth, necessary as this may prove to be, but the fullest utilization of existing resources to increase production. He stated that, while two-thirds of the people of the world are hungry and struggling to survive on

minimum or insufficient diets, obesity is the principal nutritional affliction of America.

Frank C. Croxton (Battelle Memorial Institute; retiring vice president for Section P) spoke at a luncheon following the symposium on the topic, "Scientific man and unscientific society." He observed, "The individual of today, having the ability to be objective, selfless, and unhampered by group pressures, has the capability to be scientific in thought and approach. Today, society being essentially subjective, harried by group pressures and necessarily guided by nationalistic egoism, is rarely able to be scientific. . . . It is important for each one of us to encourage individual creativity, the scientific method and the incorporation of both into the behavior of society. . . . The constantly and rapidly increasing importance of science in the lives of men and nations imposes on us the absolute necessity of assuring the position of aspiring man in our conservative or even antisocial society. . . . The scientist must be provided with the freedom necessary for creative research. He in turn must continually be aware of society's problems and his potentialities for improving human welfare."

The 1959 Industrial Science Achievement Award of Section P was presented jointly to Armour and Company and Swift & Company in recognition of the accomplishments of their respective research departments in finding practical applications of scientific knowledge in the development of a wide variety of foodstuffs and chemical products.

ALLEN T. BONNELL, *Secretary*

Institute of Management Sciences (P1)

The Institute of Management Sciences, recently affiliated with the Association, held a special program at the Chicago meeting. The symposium, "Management science," with Abraham Charnes as chairman and Allen Newell, Anatol Rapoport, and Harold Guetzkow as speakers, ran smoothly throughout and was entirely successful.

MERRILL M. FLOOD, *Program Chairman*

Society for Industrial Microbiology (P2)

A Chicago section of the Society for Industrial Microbiology was organized. There was a fine representation of local industrial microbiologists. The section is already functioning with what we hope will be an interesting program for our colleagues in the Chicago area.

A. DAVID BASKIN, *President, Chicago Section*

Education (Section Q)

Section Q had a comprehensive program of symposia, contributed papers, field trips, conferences, and reports. In general, the sessions were well attended and interest was high. In Section Q and in the programs of the affiliated societies, 18 sessions were devoted to papers which treated subjects as varied as "Radio telemetry of nerve action potentials" and "Analysis of algebra textbooks used in the Russian secondary schools." There were five lectures and a special report of the National Project for the Identification, Development, and Utilization of Human Talent. Numerous other special programs and committee meetings were also scheduled. Paul Witty's report on televising had an excellent reception, both with the audience to which he presented it, and with the press.

The excellent vice-presidential address on "Fallacies in the concept of overachievement," by Warren Findley, was well attended. The most vigorous business meeting in several years was held, and plans were laid for a more active involvement of the section committee in section affairs.

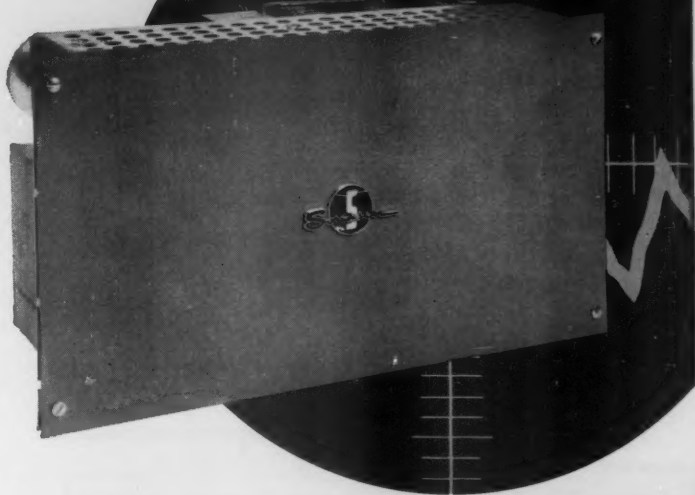
There are increasing indications, in both the section itself, and in its affiliated societies, that closer identification with the subject-matter sections is desired. This was evidenced by an expression of a need for greater opportunities and encouragement to attend the programs of other sections, and by a desire for opportunity to share more fully with other sections in the development of programs of mutual interest.

Joseph Novak (Purdue University) was elected to a 4-year term as committeeman-at-large, and John C. Flanagan (University of Pittsburgh) was elected by the Council as vice president and chairman of Section Q.

HERBERT A. SMITH, *Secretary*

Section Q and the Council for Exceptional Children held joint sessions in the morning and afternoon of 26 December. The morning session was devoted to a consideration of organic and social factors in mental deficiency and their significance to the educational program. George Yacorzynski (Northwestern University Medical School) reported research indicating that precipitate delivery and anoxia are more frequently associated with later evidences of brain damage than are prolonged labor or instrument deliveries. Bernard Demsch and William Itkin (Cooperative Re-

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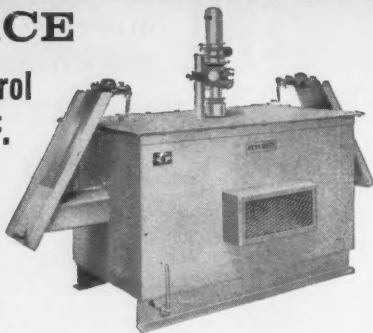
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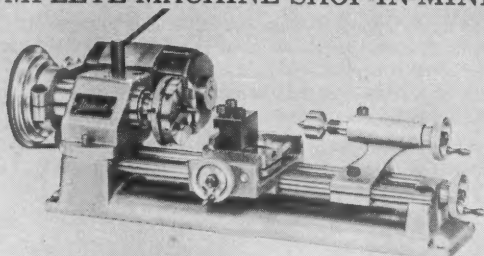
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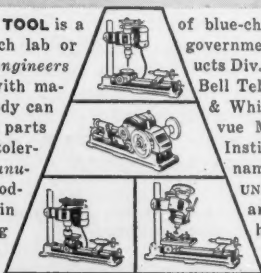
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search Project on Mental Deficiency of the Chicago public schools) presented research data strongly suggesting that individual psychological examinations utilizing either the Stanford-Binet test or the WISC test underestimate the potential of children who have recently migrated from the rural south to an urban school system, since these children appear to achieve more rapidly than their intelligence scores would predict after a few years in the urban school situation. Other papers were presented by Louise Sinderson (Joliet public schools) and Henry Turkel (Detroit, Mich.).

The afternoon session was devoted to the topic "Weapons of the school in the war against delinquency." The importance of a strong and flexible total school program was stressed in the first two papers by Louise Daugherty (Forestville School, Chicago) and Irving Abrams (director of health services, Chicago). They pointed out the need for school organization which permits the principal of a school in an underprivileged area to adapt the curriculum and the organization to the needs of the community. Abrams presented research on an extensive health survey of a large school in a problem neighborhood, revealing the high incidence of health problems in a population which also has a high delinquency rate. He recommended strengthening the school health program in such communities, particularly a roving team of medical experts, including a pediatrician, a psychiatrist, nad a neurologist, who would make rapid evaluations at the school site of children with health problems referred by the school staff. A number of other special school programs were described. One was an effective guidance and adjustment program for young people returned to a city high school after serving a term in a state school for delinquents. Another was a series of special classes in Milwaukee designed to introduce migrants to ways of living in the city and succeeding in the city schools. A third was the revised curriculum in a school for socially maladjusted adolescent girls reflecting many years of experience in the girls' branch of the Montefiore special school in Chicago. Discussion of these papers emphasized the many aspects of the school's responsibility in the prevention of delinquency. First of all, the school must be a good school providing a strong academic program preparing all young people to meet the varied demands of American citizenship; second, an effective school sys-

tem must devise and utilize a wide variety of special attacks on special problems to meet the needs of individual children and special groups of children, utilizing the disciplines of medicine, social work, and psychology as well as education.

FRANCES A. MULLEN,
Program Chairman

AAAS Cooperative Committee on the Teaching of Science and Mathematics (Q1)

Sunday, 27 December. John R. Mayor reviewed the STIP studies in science teacher education now being undertaken by several universities. These studies include use of undergraduates as laboratory assistants in science courses, appointment of science advisers for elementary school science teachers in training, development of testing programs for teacher certification, and training in laboratory procedures for more effective teaching. J. R. C. Brown reported on the program designed to encourage research in smaller colleges, specifically those engaged in teacher training. Further grants are needed to continue these programs since the heavy teaching load of science teachers in smaller colleges frequently prevents these teachers from doing any research. F. B. Dutton gave a summary of the use of special teachers of science and mathematics in grades 5 and 6. Further evaluation will be necessary before a final report can be made.

William P. Viall reviewed the plans of the National Association of State Directors of Teacher Education and Teacher Certification for a national study of certification requirements for teachers of secondary science and mathematics.

Harold E. Wise presided over a panel discussion dealing with the recent Garrett report of certification of secondary science teachers. Pertinent observations made during the discussion included (i) the need for those presently teaching science courses for teachers to up-grade these programs; (ii) integration of what is taught in elementary and secondary science courses with college courses; (iii) greater responsibility by faculty members in matters of teacher certification; (iv) comparable recognition for teaching and for research; and (v) awarding of graduate credit for at least some of the courses taken in the recommended fifth year of training for secondary science teachers.

BROTHER G. NICHOLAS,
Program Chairman

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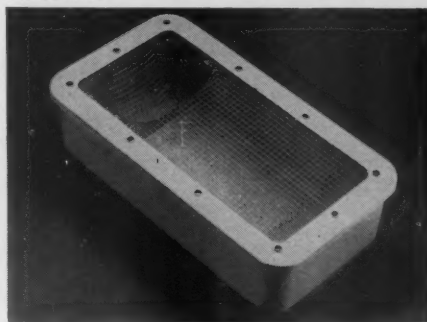
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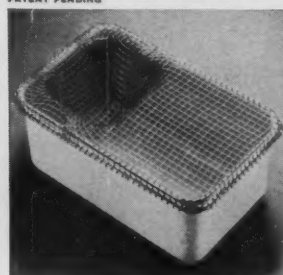
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Wednesday, 30 December. Malcolm Smith reported for the Physical Science Study Committee. Smith reviewed the status of the present course in high school physics and referred to the widespread try-out of materials during this school year. He also indicated the availability of films for the course and for teachers. E. G. Bogle (Yale University) reviewed the work of the School Mathematics Study Group which has prepared sample textbooks for grades 7 through 12; these books are being used this year by more than 600 teachers in 100

schools on an experimental basis. Teachers are reporting experiences, and revision of the textbooks will be made during the summer of 1960 on the basis of these experiences. Reference was also made to the panels on monographs, teacher education, mathematics for slow students, and mathematics in grades 4-6. Arnold Grobman (University of Colorado), director of the Biological Sciences Curriculum Study, indicated that the first serious writing on the project would be carried on during the summer of 1960 on a basis similar to that

used by the physics and mathematics studies. In the meantime, teams are working on teacher education materials, on identification of qualities of gifted biology teachers, and on the goals of biology education from kindergarten through grade 12. B. F. Heller (University of Minnesota, Duluth) reviewed the work of the Teaching Resources Planning Group in Geology held at Duluth last summer. The project is directing its attention to preparation of supplementary materials for elementary and secondary schools. The plan does not call for the recommendation of a year's course in geology in the secondary school. Robert Silber, representing a committee of the Division of Chemical Education of the American Chemical Society, reported on plans for curriculum studies in chemistry and included reference to the Chemical Bonds Approach Project which developed a sample course at Reed College last summer.

JOHN R. MAYOR, *Program Chairman*

National Science Teachers Association (Q6)

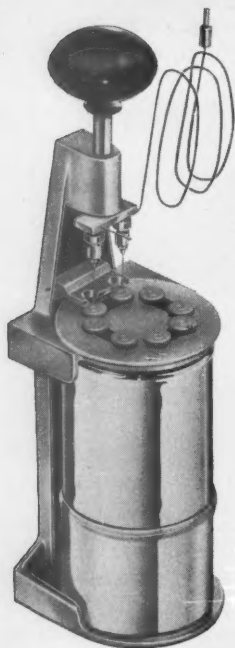
The general session of the science teaching societies affiliated with the American Association for the Advancement of Science, held on the morning of 27 December, had as its theme, "Man and space travel." John A. O'Keefe (Theoretical Division, National Aeronautics and Space Administration) presented a paper on the surface of the moon, dealing with the phenomenon of retroreflection. James C. Fowler (Cranbrook Institute of Science) spoke on the place of planetaria in teaching space science.

Concurrent elementary school, junior high school, and senior high school sessions dealing with "Here's how I teach space science" were held that afternoon. These sessions were chaired respectively by Helen J. Challand (National College of Education), Edward Victor (Northwestern University), and John S. Richardson (Ohio State University). These programs, offering practical classroom ideas, have been a popular feature at previous meetings. At the senior high school session a group of able students from Evanston Township High School demonstrated how they learn physics of an extremely advanced nature.

A symposium on K-12 planning, which began on 28 December, under the leadership of Donald G. Decker, president of the National Science Teachers Association, continued through three sessions. At the preliminary meet-

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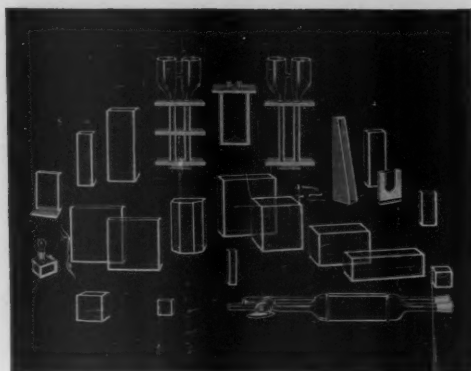
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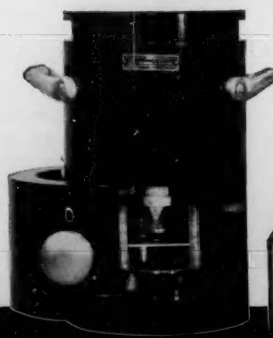
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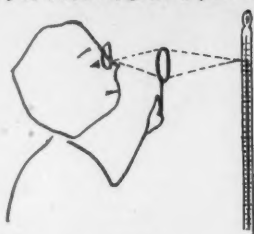
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ing, critical problems of curriculum planning were highlighted by a panel of speakers. The problems thus identified were the basis of six concurrent round-table discussions which followed. At the third session, the members of the round-table groups reassembled to summarize their considerations of the problems and issues involved in K-12 curriculum planning. Data collected by a questionnaire prepared by Decker indicated that those present felt (i) that a carefully integrated K-12 program is the aim of science education and (ii) that NSTA should provide leadership in developing such a program to be modified by schools for local use.

J. Myron Atkin (University of Illinois) was chairman of a joint assembly on elementary science teaching problems on 29 December.

On 30 December, Zachariah Subarsky (Bronx High School of Science) presided at an invitational conference providing opportunities for scientists to hear about, discuss, and counsel on the program and activities of the Future Scientists of America Foundation.

MARGARET J. MCKIBBEN,
Program Coordinator

Science Teaching Societies (Q7)

This is the final statement from the general chairman for the 1959 joint meetings of the Science Teaching Societies affiliated with AAAS. From all reports everything proceeded smoothly.

I appreciate the generous cooperation which I received from the officers of the AAAS and the societies, from the committee chairmen, and from members of all committees. I also appreciate the fine cooperation of the Sherman Hotel personnel.

The publicity committee worked hard on their tedious but important task of addressing thousands of letters to the administrators in the adjacent states.

The hospitality committee did a fine job of manning the tables and answering questions. Students from Rosary College and Chicago Teachers College volunteered for these posts.

Because of the decision to use the facilities and services of the Chicago school system for projecting slides, the services of the physical facilities committee were not used to the fullest possible extent.

The success of the coffee hour committee was evident from the large attendance at that function and the apparent enjoyment on the part of those who attended of this period set aside for visiting with friends.

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For all these efforts I am deeply grateful. The combined activities and cooperation of many people contributed to the success of the Chicago meeting.

MURIEL BEUSCHLEIN, *Coordinator*

Academy Conference (X1)

The Academy Conference held a very successful and well attended meeting at the Hotel Sherman on 27-28 December. The first session was given over to problems of the Junior Academies of Science. Elnore Stoldt (Jacksonville, Ill.) organized and presided over the program, which featured talks by Harry Bennett (Louisiana Academy of Science), M. S. McCay (Tennessee Junior Academy Program), and C. Leplie Kanatzar (Illinois State Academy of Science).

The president of the conference, A. M. Winchester (Stetson University) presided over the Monday morning session, which featured reports of representatives of the member academies from all over the nation. Interesting discussions were also presented on the methods of application for and utilization of grants from national organizations by John Yarbrough (Meredith College) and Clinton Baker (Southwestern at Memphis). Robert C. Miller (California Academy of Science) was selected as the president elect of the Academy Conference, and E. Ruffin Jones (University of Florida) was re-elected as secretary.

John G. Arnold (Loyola University) presided over the Monday afternoon session which featured problems of the senior academies. Speakers included: W. C. Oelke (Grinnell College), Robert C. Miller (California Academy), Harold Hansen (Minnesota Academy), P. H. Yancey (Alabama Academy), and Wayne Taylor (Michigan Academy).

The dinner meeting on Monday evening was presided over by the retiring president John Yarbrough and featured the presidential address by A. M. Winchester. His topic was "Tribulations of the textbook author."

A. M. WINCHESTER, *President*

Session on junior academies of science. Beginning with the conference at Navy Pier in Chicago 4 years ago, adult leaders of junior academies of science have pursued possibilities for improving



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March 1. A regional approach to historical geology, this new basic textbook covers the continent's evolution in terms of its three major structural units: the Appalachian and Cordilleran geosynclines, the stable interior, and the Canadian Shield. Throughout, the connection between the structural behavior of the geosynclines, basins, and shelf areas, and the pattern of sediments deposited in them, is stressed.

The orogenic history of the Canadian Shield is treated in the light of concepts that have emerged mostly within the past decade. The evolution of life in North America is discussed in a separate section. Important study aids include summaries of the plant and animal kingdoms; a wealth of fine photographs, maps, and diagrams; and annotated bibliographies. 1960. 290 illus.; 418 pp. \$7.50

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the quality of junior academies, so that those groups might be of greater service to young persons. It seemed fitting at the 1959 meeting, therefore, to focus attention on what has been accomplished and to point out a few of the things that are being done to implement the suggested programs.

For brief review, the recorder for the meeting, H. Neil Hardy (Indiana University Laboratory School), recalled the ten proposals developed at the first meeting and indicated which have been implemented wholly or in part. It was noted that there is still need for more high school teachers to assume positions of leadership in the academies and for more exchange of ideas and information among groups.

Representing the host state, Robert C. Wallace, chairman of the Illinois Junior Academy, was present. As samples of activities of one academy, the chairman of the meeting presented two students, Lynda Hartman and David Lloyd, who were selected by the Illinois Junior Academy to honorary membership in the AAAS for this year. She also presented Earl O. Ehrhardt (Illinois Bell Telephone Company), who described the Businessman's Advisory Committee set up by the Illinois Chamber of Commerce to aid the Junior Academy with advisory and financial contributions from industry and business.

The program consisted of three presentations, two of which concerned programs for state junior academies where National Science Foundation aid is being used. Harry J. Bennett (Louisiana Junior Academy of Science), described the program being followed in Louisiana, and M. S. McCay (Tennessee Junior Academy Program) spoke of the methods used in Tennessee.

Presenting a contrasting method used to encourage participation of young persons in science activities, C. Leple Kanatzar (Illinois Academy of Science), described his observations of the Young Naturalists' and Young Technicians' Circles, which are the Soviet counterpart of American junior academies of science. To illustrate his talk, he used slides of photographs he made on two visits to the U.S.S.R.

This session was well-attended. Most persons present had attended at least one of the previous meetings that dealt with the junior academies. There was expression of the hope that continued effort will be made to bring these groups into closer contact and to improve their services.

ELNORE STOLDT, Program Chairman

Encouraging Women To Select and To Advance in Scientific Careers (X2)

The second conference, cosponsored by Sigma Delta Epsilon and the American Council on Women in Science, met on Monday afternoon, 28 December. Alan T. Waterman, director of the National Science Foundation, the keynote speaker, discussed "scientific womanpower—a neglected resource." He said, "At a time when the extent and quality of our scientific manpower resources are of critical importance we are failing to exploit the potentialities of women for scientific research and the teaching of science. . . . As a nation, we cannot afford this serious waste of intellectual resources. Women's general lack of interest in the scientific and technical fields is traceable to (i) prevailing cultural and social attitudes; (ii) discriminatory practices which deprive them of equal opportunities with men for advancement and recognition; and (iii) the difficulties of combining a professional career with homemaking and motherhood." After questions and discussion from the audience, two group discussions were held simultaneously.

Captain Apollonia Adams, chief of the Division of Nursing Resources, Public Health Service, Department of Health, Education, and Welfare, and Hazel Bishop, president of H-B Laboratories, spoke to one group about problems of the working woman scientist. Captain Adams was moderator of the group discussion.

The other group met with Mary Louise Robbins, department of bacteriology, George Washington University School of Medicine, who discussed undergraduate and graduate training for women in science. Dr. Robbins was moderator of the audience discussion.

The two groups then met together to hear summaries of the two discussions. Commander Ernestine Thurman, Division of Special Grants, National Institutes of Health, reported the discussion on problems of the working woman scientist, and Esther Hand, traveling science teacher, Michigan State University, reported the discussion on undergraduate and graduate training.

ETHALINE CORTELYOU, Chairman

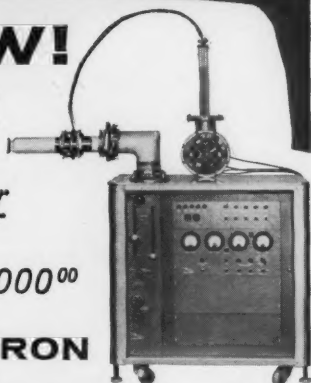
Chicago Academy of Sciences (X6)

A symposium on the physiology of reproduction of birds, cosponsored by the Chicago Academy of Sciences and Section F, was held on 28 and 29 December. The Monday sessions, which

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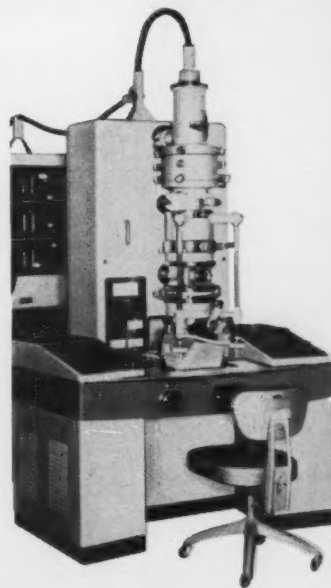
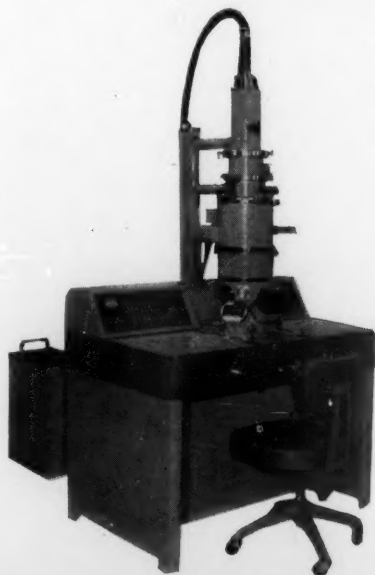
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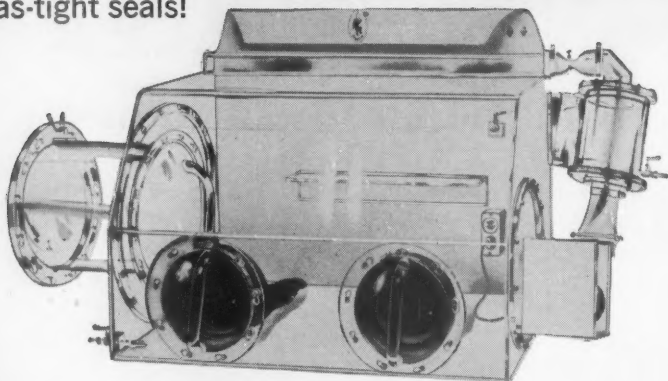
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were attended by 50 to 60 people, covered the general topics of environmental control of the reproductive system (Wolfson), the role of the hypothalamus (Ralph) and the pituitary (Nalbandov and Harris) in reproduction, the endocrinology of embryos (Watterson, Pincus, Meyer), and the hormonal responses of the female (van Tienhoven) and male (Hilton) reproductive tracts and accessories. These sessions were chaired by McLean and Edgren. The Tuesday sessions were less well attended, 25 to 35 persons; with Beecher and Wolfson in the chair, they covered the effects of the sex hormones on lipid (Pick and Cook) and calcium (McLean) metabolism, a discussion of secondary sex characteristics that might be hormonally controlled (Beecher), and sex behavior and the behavioral effects of sex hormones (Guhl and Lehrman). Although attendance at these sessions was rather small, discussion of the excellent series of papers was animated.

Beecher and his academy staff are to be congratulated for the coffee and other refreshments served during the breaks and for arranging the informal luncheons that allowed continuation of discussions. I was particularly pleased with the exchange of ideas that resulted from gathering ornithologists, naturalists, physiologists, endocrinologists, pharmacologists, and psychologists together in the same room.

RICHARD A. EDGREN, *Secretary and Program Chairman*

Conference on Scientific Manpower (X8)

The Conference on Scientific Manpower met on 28 December to consider the general theme of higher education and training in emerging fields of technology. Morning and afternoon sessions were held, and six papers were presented dealing with specialized fields.

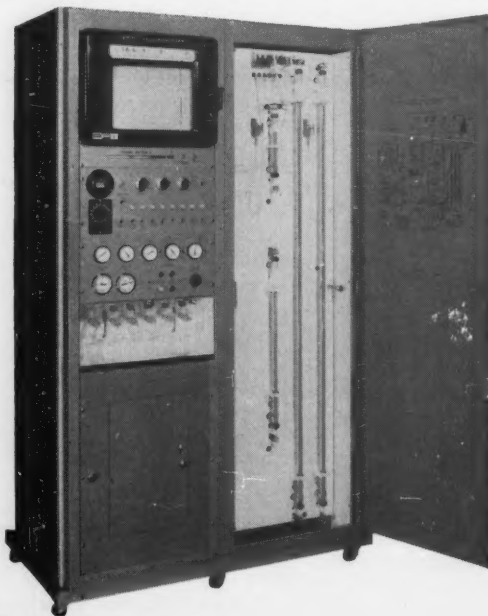
R. D. Maxson (Commonwealth Edison Company and the Western Society of Engineers) served as chairman of the morning session. Harold L. Hazen (Massachusetts Institute of Technology), in discussing engineering education, described the trend toward sound general education with emphasis on science and mathematics; greater depth, generality, and fundamental relationships in advanced science applications; and development of basic intellectual skills, including rigor of analysis, breadth of concept, creativity, and judgment, rather than specific engineering practice. John P. Hagen (National Aeronautics and

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Space Administration) reviewed the many fields included in "space sciences" and urged that thorough training in analysis and understanding of the scientific method be included in graduate science training. Gordon A. Riley (Yale University) noted the unusual factors associated with training in oceanography and advocated greater fellowship support for this field.

S. B. Ingram (Bell Telephone Laboratories) presided over the afternoon session. Charles W. Shilling (Atomic Energy Commission) reported on training programs supported by his agency and on the importance of public attitudes in developing excellence. W. R. Hibbard, Jr., (Metallurgy and Ceramics Research Department, General Electric Co.) placed emphasis on the field of metallurgy requirements for quality rather than quantity of trained manpower. Richard D. Greckler (Aerojet-General Corp.), discussing training for work on chemical fuels, urged "teaching the meaning of the fundamental laws of nature."

The conference was again sponsored by the Engineering Manpower Commission, the Scientific Manpower Commission, the National Research Council, the National Science Foundation, and AAAS Section M-Engineering. Papers delivered at the conference will again be published by the NSF. Copies should be available by March.

THOMAS J. MILLS, *Program Chairman*

Sigma Delta Epsilon (X16)

The grand chapter and dinner meeting of Sigma Delta Epsilon was held in the Walnut Room of the Morrison Hotel on 29 December. Approximately 60 attended the luncheon for all women in science on 30 December. Delaphine Wyckoff (Wellesley College) spoke on "Science in education and education in science." She emphasized the importance of scientific training for both girls and boys in the lower grades through college for a better understanding of science in this space age.

Two chapters were established in 1959—Tau, with members in southern California and western Arizona, and Upsilon, at Indiana University. The organization has 20 chapters.

Mary Lou Pritchard (Lincoln, Neb.) has been appointed editor of the *Newsletter*. Betty McLaughlin, (Washington, D.C.) was elected permanent secretary.

The fraternity recommended that one or more grants-in-aid be awarded annually for research especially for older



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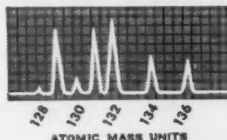
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A national honorary membership (the highest award in Sigma Delta Epsilon) was awarded to Louise A. Boyd, explorer and author, of San Rafael, Calif. She is known for her exploratory and scientific work in the arctic polar region, Greenland, Spitzbergen, and Franz Joseph Land. In addition to polar research, her interests include geography, geology, botany, and photogrammetry.

ESTHER S. ANDERSON, *President*

Meetings

Forthcoming Events

March

18-19. American Laryngological Assoc., Miami Beach, Fla. (L. Richards, Massachusetts Institute of Technology, Cambridge.)

20-23. American Assoc. of Dental Schools, Chicago, Ill. (R. Sullen, 840 N. Lake Shore Drive, Chicago 11.)

20-26. American Cong. on Surveying and Mapping, Washington, D.C. (C. E.

Palmer, American Soc. of Photogrammetry, 1515 Massachusetts Ave., NW, Washington 5.)

20-26. American Soc. of Photogrammetry, Washington, D.C. (C. E. Palmer, ASP, 1515 Massachusetts Ave., NW, Washington 5.)

21-24. American Acad. of General Practice, 12th annual, Philadelphia, Pa. (AAGP, Volker Blvd. at Brookside, Kansas City 12, Mo.)

21-24. Institute of Radio Engineers, natl. conv., New York, N.Y. (L. G. Cumming, IRE, 1 E. 79 St., New York 21.)

22-24. High-Polymer Physics, 20th, Detroit, Mich. (T. L. Smith, American Physical Soc., Stanford Research Inst., Menlo Park, Calif.)

23-25. National Council on Alcoholism, annual, New York, N.Y. (M. Ross, American Psychiatric Assoc., 1700 18 St., NW, Washington 9.)

23-25. Optical Spectrometric Measurements of High Temperatures, symp., Chicago, Ill. (F. Brech, Laboratories for Applied Science, Univ. of Chicago, 6220 S. Drexel Ave., Chicago 37.)

24-25. Human Factors in Electronics, 1st annual symp. (IRE), New York, N.Y. (J. E. Karlin, Bell Telephone Laboratories, Murray Hill, N.J.)

24-26. American Assoc. for the History of Medicine, Charleston, S.C. (J. B. Blake, c/o Smithsonian Institution, Washington 25.)

24-26. Aviation Education, 4th natl. conf., Denver, Colo. (W. Kinkley, Superintendent of Schools, Aurora, Colo.)

26-27. American Psychosomatic Soc., 17th annual, Montreal, Canada. (E. D. Wittkower, APS 265 Nassau Rd., Roosevelt, N.Y.)

28-31. Exploitation of Natural Animal Populations, symp., Durham, England. (E. D. Le Cren, British Ecological Soc., The Ferry House, Ambleside, Westmorland, England.)

29-31. American Power Conf., 22nd annual, Chicago, Ill. (R. A. Budenholzer, Mechanical Engineering Dept., Illinois Inst. of Technology, 3300 Federal St., Chicago 16.)

29-2. National Science Teachers Assoc., 8th annual conv., Kansas City, Mo. (Miss M. R. Broom, NSTA, National Education Assoc., 1201 16 St., NW, Washington 4.)

30-31. Adrenergic Mechanisms, Ciba Foundation symp. (by invitation only), London, England. (G. E. W. Wolstenholme, Ciba Foundation, 41 Portland Pl., London, W.1, England.)

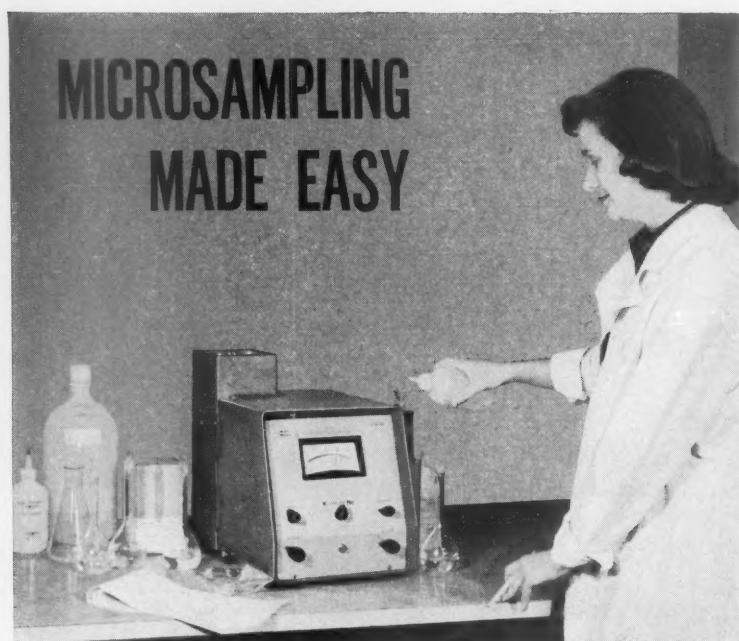
31-1. Continuous Culture of Microorganisms, symp., London, England. (R. Elsworth, c/o Ministry of Supply, Microbiological Research Establishment, Porton, Salisbury, Wilts., England.)

31-2. American Gastroenterological Assoc., New Orleans, La. (W. Volwiler, Dept. of Medicine, Univ. of Washington, Seattle.)

April

1-3. American Soc. of Internal Medicine, San Francisco, Calif. (R. L. Richards, 350 Post St., San Francisco 8.)

1-3. American Soc. for the Study of Sterility, Cincinnati, Ohio (H. H. Thomas, 920 S. 19 St., Birmingham 5, Ala.)



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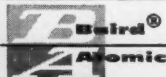
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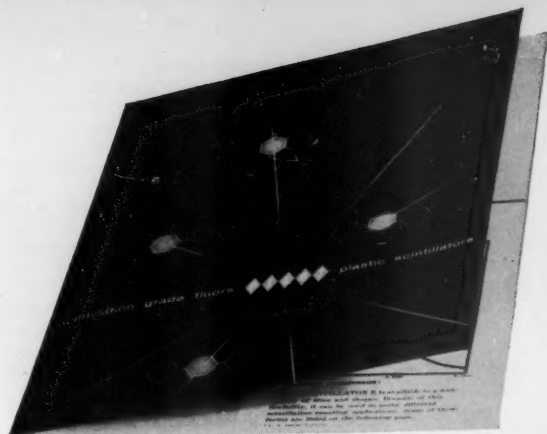
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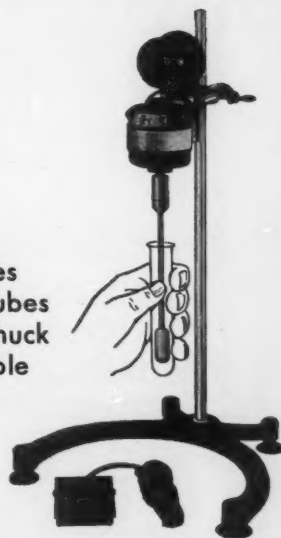
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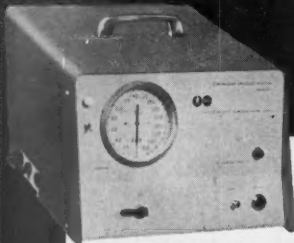
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2. Paleontological Research Institution, Ithaca, N.Y. (Miss R. S. Harris, 126 Kelvin Pl., Ithaca.)

2-6. American College of Obstetrics and Gynecologists, Cincinnati, Ohio. (D. F. Richardson, 79 W. Monroe St., Chicago 3.)

3-6. American Surgical Assoc., White Sulphur Springs, W.Va. (W. A. Altemeier, Cincinnati General Hospital, Cincinnati, Ohio.)

3-7. International Anesthesia Research Soc., Washington, D.C. (A. W. Friend, E. 107 St. and Park Lane, Cleveland 6, Ohio.)

3-8. Nuclear Cong., New York, N.Y. (P. Lange, Engineers Joint Council, 29 W. 39 St., New York.)

4-5. Solar Energy, symp., Gainesville, Fla. (J. C. Reed, Mechanical Engineering Dept., Univ. of Florida, Gainesville.)

4-6. American Inst. of Electrical Engineers, Houston, Tex. (N. S. Hibsham, AIEE, 145 N. High St., Columbus 15, Ohio.)

4-6. American Inst. of Mining, Metallurgical and Petroleum Engineers (43rd Natl. Open Hearth Steel Conf. and Blast Furnace, Coke Oven and Raw Materials Conf.), Chicago, Ill. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 18.)

4-6. American Oil Chemists' Soc., Dallas, Tex. (Mrs. L. R. Hawkins, AOCS, 35 E. Wacker Drive, Chicago 1, Ill.)

4-6. Chemical and Petroleum Instrumentation Symp., 3rd natl., Rochester, N.Y. (Director, Technical & Educational Services, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.)

4-7. Atomic Exposition, New York, N.Y. (Atomic Exposition, 117 S. 17 St., Philadelphia, Pa.)

4-8. American College of Physicians, annual, San Francisco, Calif. (M. Ross, American Psychiatric Assoc., 1700 18 St., Washington 9.)

4-8. American Meteorological Soc., 3rd applied meteorology conf., Santa Barbara, Calif. (H. G. Houghton, AMS, Dept. of Meteorology, Massachusetts Inst. of Technology, Cambridge 39.)

4-8. American Soc. of Mechanical Engineers, New York, N.Y. (D. B. MacDougall, ASME, 29 W. 39 St., New York.)

4-9. American College of Physicians, San Francisco, Calif. (E. R. Loveland, 4200 Pine St., Philadelphia 4.)

5-7. Instrument Soc. of America (Natl. Chemical and Petroleum Symp.), Rochester, N.Y. (H. S. Kindler, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.)

5-7. Naval Structural Mechanics, 2nd symp., Providence, R.I. (E. H. Lee, Brown Univ., Providence.)

5-14. American Chemical Soc., natl., Cleveland, Ohio. (A. T. Winstead, ACS, 1155 16 St., NW, Washington 6.)

6-8. Biochemistry and Pharmacology of Compounds Derived from Marine Organisms, symp., New York, N.Y. (R. F. Nigrelli, Dept. of Marine Biochemistry and Ecology, New York Aquarium, Seaside Park, Eighth St. and Surf Ave., Brooklyn 24, N.Y.)

6-8. Hyper-Environments—Space Frontier (Inst. of Environmental Scientists), Los Angeles, Calif. (M. S. Christensen,

IES, 6251 Marita St., Long Beach 15, Calif.)

6-8. Radiofrequency Spectroscopy Group, Nottingham, England. (J. E. Ingram, RSG, c/o Dept. of Electronics, Telecommunications and Radio Engineering, Univ. of Southampton, England.)

6-8. Structural Design of Space Vehicles, conf., Santa Barbara, Calif. (A. F. Deaham, 925 Book Bldg., Detroit 26, Mich.)

6-9. Mineral Processing, intern. cong., London, England. (B. W. Kerrigan, Institution of Mining and Metallurgy, 44 Portland Pl., London, W.1, England.)

7-8. Cathode Protection, European symp., Frankfurt am Main, Germany. (Secrétariat du Symposium, Deutsche Gesellschaft für Metallkunde, Alteburgerstrasse 402, Köln-Marienburg, Germany.)

7-9. American Assoc. of Railway Surgeons, Chicago, Ill. (C. C. Guy, 5800 Stony Island Ave., Chicago 37.)

7-9. Association of Surgeons of Great Britain and Ireland, Birmingham, England. (F. A. R. Stammers, 47 Lincolns Inn Fields, London, W.C.2, England.)

7-9. Optical Soc. of America, Washington, D.C. (K. S. Gibson, OSA, Natl. Bureau of Standards, Washington 25.)

8-9. American Assoc. of University Professors, Detroit, Mich. (P. R. David, Univ. of Oklahoma, Norman.)

8-9. New Mexico Acad. of Science, Socorro. (K. G. Melgaard, P.O. Box 546, University Park, N.M.)

8-9. Southern Soc. for Philosophy and Psychology, Biloxi, Miss. (E. Henderson, Florida State Univ. Tallahassee.)

8-11. American Dermatological Assoc., Boca Raton, Fla. (W. M. Sams, 308 Ingraham Bldg., Miami 32, Fla.)

9-10. Histochemical Soc., 11th annual, New York, N.Y. (H. W. Deane, Albert Einstein College of Medicine, Bronx 61, N.Y.)

10-11. American Soc. for Artificial Internal Organs, Chicago, Ill. (C. K. Kirby, ASFAIO, 3400 Spruce St., Philadelphia 4, Pa.)

11-13. American College of Surgeons, Minneapolis, Minn. (H. P. Saunders, 40 E. Erie St., Chicago 11, Ill.)

11-13. Forest Tree Growth, intern. conf., Tucson, Ariz. (Forest Tree Growth Conf., Laboratory of Tree-Ring Research, Univ. of Arizona, Tucson.)

11-14. American College Personnel Assoc., Philadelphia, Pa. (M. D. Hardee, Florida State Univ., Tallahassee.)

11-14. American Meteorological Soc., 8th weather radar conf., San Francisco, Calif. (H. G. Houghton, AMS, Dept. of Meteorology, Massachusetts Inst. of Technology, Cambridge 39.)

11-15. American Assoc. of Immunologists, Chicago, Ill. (C. Howe, Columbia Univ., College of Physicians and Surgeons, New York 22.)

11-15. American Inst. of Nutrition, Chicago, Ill. (G. M. Briggs, Div. of General Medical Sciences, National Institutes of Health, Bethesda, Md.)

11-15. American Physiological Soc., Chicago, Ill. (R. G. Daggs, 9650 Wisconsin Ave., NW, Washington 14.)

11-15. American Soc. for Experimental Pathology, Chicago, Ill. (F. J. A. McManus, Univ. of Alabama Medical Center, Birmingham.)

11-15. American Soc. for Pharmacology and Experimental Therapeutics, Chicago, Ill. (K. H. Beyer, Merck Sharp & Dohme Research Laboratories, West Point, Pa.)

11-15. Federation of American Socs. for Experimental Biology, Chicago, Ill. (M. O. Lee, 9650 Wisconsin Ave., NW, Washington 14.)

11-16. American Assoc. of Anatomists, New York, N.Y. (L. B. Flexner, Dept. of Anatomy, School of Medicine, Univ. of Pennsylvania, Philadelphia 4.)

11-16. American Soc. of Biological Chemists, Chicago, Ill. (F. W. Putnam, Dept. of Biochemistry, Univ. of Florida, Gainesville.)

11-16. Anatomical Congress, 7th intern., New York, N.Y. (D. W. Fawcett, Dept. of Anatomy, Harvard Medical School, Boston 15, Mass.)

11-16. Congress of Anatomy, 7th intern., New York, N.Y. (J. C. Hinsey, New York Hospital, Cornell Medical Center, 525 E. 68 St., New York 21.)

11-16. International Anatomical Cong., New York, N.Y. (D. W. Fawcett, Dept. of Anatomy, Cornell Univ. Medical College, 1300 York Ave., New York 21.)

13-15. American Public Health Assoc. (Southern Branch), Memphis, Tenn. (L. M. Groves, Shelby County Health Dept., Memphis.)

14-16. Pennsylvania Acad. of Science, Williamsport. (K. B. Hoover, Messiah College, Grantham, Pa.)

15-16 Eastern Psychological Assoc., Atlantic City, N.J. (C. H. Rush, Standard Oil Co. (N.J.), Rockefeller Plaza, New York, N.Y.)

18-19. Radioactivity in Man, Measurements and Effects of Internal Gamma Ray Emitting Radiosotopes, AAAS symp., Nashville, Tenn. (G. R. Meneely, School of Medicine, Vanderbilt Univ., Nashville 5.)

18-21. American Astronomical Soc., Pittsburgh, Pa. (J. A. Hynek, Smithsonian Astrophysical Observatory, 60 Garden St., Cambridge 38, Mass.)

18-22. Association of American Geographers, Dallas, Tex. (A. C. Gerlach, Map Div., Library of Congress, Washington 25.)

18-22. European Soc. of Ophthalmology, 1st cong., Athens, Greece. (P. Velissaropoulos, c/o Ophthalmology Clinic, Faculty of Medicine, 26, rue de l'Université, Athens, Greece.)

19-21. Active Networks and Feedback Systems, 10th intern. symp., New York, N.Y. (H. J. Carlin, Microwave Research Inst., Polytechnic Inst. of Brooklyn, 55 Johnson St., Brooklyn 1, N.Y.)

19-21. American Soc. of Lubrication Engineers, annual, Cincinnati, Ohio. (C. L. Willey, ASLE, 84 E. Randolph St., Chicago, Ill.)

19-22. Metallurgy of Plutonium—session on nuclear fuels, intern. symp., Grenoble, France. (Société Française de Métallurgie, 25, rue de Clichy, Paris, France.)

20-22. Biological Waste Treatment, 3rd conf., New York, N.Y. (W. W. Eckenfelder, Dept. of Civil Engineering, Manhattan College, New York 71.)

20-22. Manned Space Stations, Inst. of the Aeronautical Sciences symp., Los Angeles, Calif. (E. Levin, Rand Corp., 1700 Main St., Santa Monica, Calif.)

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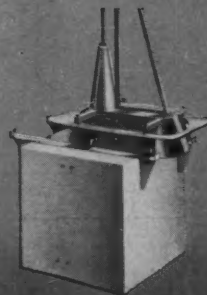


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■ **PLASMA GENERATOR** supplies a continuous flow of air at temperatures up to 18,000°F with pressures characteristic of the hypersonic re-entry of ballistic missiles. Gases are heated in passing through a 20 to 1000 kw arc. (Avco Research and Advanced Development Division, Dept. Sci320, 201 Lowell St., Wilmington, Del.)

■ **FUNCTION GENERATOR** operates essentially as an adjustable nonlinear potentiometer and will produce any mathematical or empirical curve with 34-chord accuracy. Curves may be generated singly with ten shaft turns or as continuous repetitive functions with unidirectional shaft rotation. Adjustments can be made while the instrument is operating. Each voltage level is selectable to within ± 0.5 percent of desired value. (Perkin-Elmer Corp., Dept. Sci-346, Norwalk, Conn.)

■ **X-RAY MOTION-PICTURE CAMERA** operates as auxiliary equipment to the x-ray generator by photographing the output of an image amplifier tube that in turn intensifies the output of an x-ray excited phosphor. The camera is equipped with an $f/0.95$ lens of 25-mm focal length. Exposure of the patient is minimized by a device that limits x-ray exposure to periods of frame sequence. Four frame rates from 7.5 to 60 per second are provided. (Photomechanisms, Inc., Dept. Sci353, 6 West 18 St., Huntington Station, L.I., N.Y.)

■ **VARIABLE DELAY LINES** consist of a continuously variable delay line that can achieve a smallest incremental delay less than 0.08 μsec , and a step-variable delay line serving as coarse control with total delay up to 32 μsec . Rise time is less than 7 percent of the time delay. Output impedance of the 32 μsec total delay model is 1300 ohm. (Ad-Yu Electronics Lab Inc., Dept. Sci359, 249 Terhune Ave., Passaic, N.J.)

■ **LIQUID SENSOR** is designed to detect the presence or absence of liquid at a probe sensing point. In operation, a light beam originating within the probe assembly travels through the probe and into the liquid. In the absence of liquid, the probe tip internally reflects the light beam, causing a relay to be energized. In the presence of liquid the light beam is diffused into the liquid. (Pioneer-Central Div., Bendix Aviation Corp., Dept. Sci368, Davenport, Iowa.)

■ **AUDIOMETER** with record playback and desk speaker permits the operator to make 13 major pure tone and speech tests. The audiometer includes a Wien bridge oscillator with a tone interrupter with 0.1-sec rise and decay time without click. Frequency range is 125 to 8000 cy/sec. A masking control is calibrated in effective masking at 1000 cy/sec. Various accessories are available. (Zenith Radio Corp., Dept. Sci-364, 6001 W. Dickens Ave., Chicago 39, Ill.)

■ **GLASS-CERAMIC FRIT** can be used to seal aluminosilicate glasses to themselves, to molybdenum, or to tungsten, and to seal molybdenum and tungsten to themselves. Sealing and service temperature is 750°C. It can be used also with other materials, with expansion coefficients in the range 40 to 50 $\times 10^{-7}$, that can withstand the sealing temperature. (Corning Glass Works, Dept. Sci-366, Corning, N.Y.)

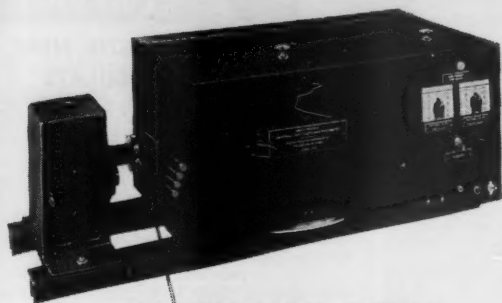
■ **SYRINGE** is gas-tight for use with corrosive liquids. The syringe incorporates a stainless-steel plunger, coated with Kel-F, and a Teflon gasket. Plunger movement is said to be stiff but smooth. Leak-proof range is 20 mm-Hg to 3 atm. Calibration of scales is said to be accurate to ± 1 percent or better. (Hamilton Co., Inc., Dept. Sci367, Box 307, Whittier, Calif.)

■ **VIBRATION METER** is a battery-powered, transistorized unit that reads directly displacement, velocity, and acceleration of vibration. The instrument accepts simultaneously outputs of three velocity pickups and three crystal accelerometers, one output at a time being selected as desired. Acceleration is measured to 1000 grav, velocity from 0.01 to 100 in./sec, and displacement from 0.001 to 10 in., all with ± 5 percent accuracy. Plug-in filters may be switched in to remove low-frequency components. (Southwestern Industrial Electronics Co., Dept. Sci360, 10201 Westheimer Rd., Houston 19, Tex.)

■ **PRESSURE SWITCHES** are designed for single pole, single throw switching of electrical circuits in response to pressure changes in fluids. Switch mechanism is isolated from the pressure medium. Ranges available are 1 to 500 lb/in.² gage. Electrical rating is 100 ma inductive, 200 ma resistive. (Bourns Inc., Dept. Sci374, P.O. Box 2112, Riverside, Calif.)

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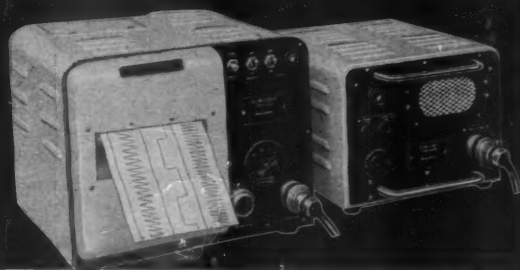
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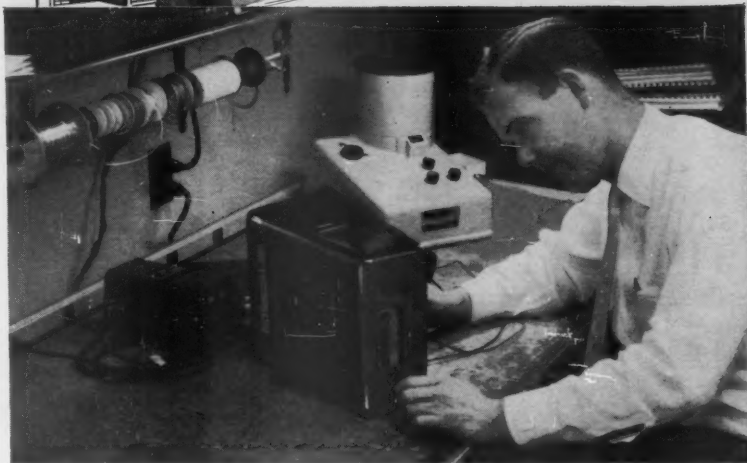
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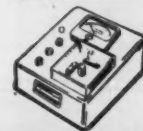
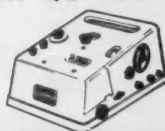
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■ **TRITIUM MONITOR** detects 10^{-19} c/ml of tritium in air. Four ranges of 10^{-11} to 10^{-14} amp full scale correspond to about 2.0 to 0.002 rep integrated dose

per hour. Ion chamber volume is 850 cm³. Zero drift is less than 5×10^{-10} amp in 24 hr. Short-period noise is less than 4.0×10^{-10} amp r.m.s. from natural radioactivity. (Applied Physics Corp., Dept. Sci384, 2724 South Peck Rd., Monrovia, Calif.)

■ **CHROMATOGRAPH** performs continuously unidimensional paper-chromatography separations. The solution to be separated is deposited on the upper edge of a slowly rotating vertical paper cylinder. Twenty-eight funnels and collecting tubes, arranged in a circle, receive the separated fractions from the serrated lower edge of the paper. As a result of the cylinder rotation, each fraction is characterized by a unique slope of its path from source point to collector, the slope being a function of the rate of migration down the paper. Four rotational speeds are selectable from 1 to 4 rev/24 hr. (Arthur S. LaPine and Co., Dept. Sci365, 6001 S. Knox Ave., Chicago 29, Ill.)

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■ **TAPE EDITING CONSOLE** for paper tape consists of a numerical keyboard, a control and comparison section with six-digit decimal readout, two tape readers, and one tape perforator. Tape may be produced from source data entered at the keyboard, or it may be reproduced from a master tape placed in one of the readers. Tape verification is accomplished either through keyboard re-entry or through comparison in the two read stations. Tape-to-tape duplication and verification can be performed at 60 characters per second. Standard tape widths 0.687, 0.875, and 1.000 in. are accommodated. (Tally Register Corp., Dept. Sci335, 5300 14th Ave. N.W., Seattle 7, Wash.)

■ **SIGNAL GENERATOR** covering the frequency range 1300 to 2500 Mcy/sec can be frequency modulated by application of external signals having modulation band widths up to 500 kcy/sec. A nominal 2-Mcy/sec peak-to-peak deviation is produced by a modulating amplitude of 1.0 volt peak-to-peak. Radio-frequency output is adjustable between 0 and -110 dbm. Deviation linearity is 1 percent. (Sierra Electronic Corp., Dept. Sci388, 3885 Bohannon Drive, Menlo Park, Calif.)

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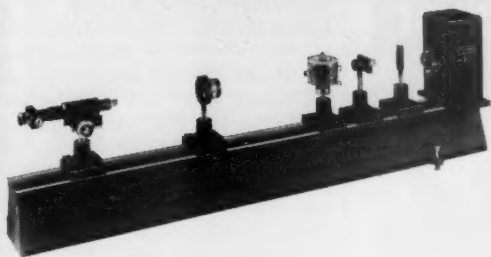
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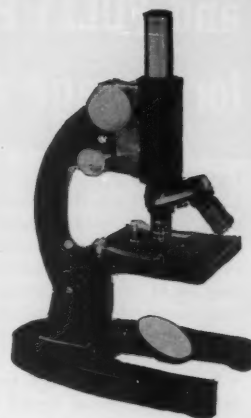
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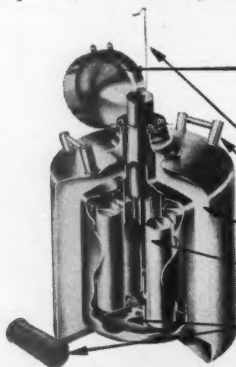


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Letters

(Continued from page 474)

cal diagnosis that is covered in the article "Reasoning foundations of medical diagnosis," by R. S. Ledley and L. B. Lusted [*Science* **130**, 9 (1959)]. In that article mathematical methods are used to separate basically quantitative values from the so-called "intangibles" or value decisions frequently required of the physician that involve moral, ethical, social, and economic considerations of great complexity. As pointed out in that article, the use of the computer might "enable the physician to define more clearly the intangibles involved and therefore enable him to concentrate full attention on the more difficult judgments."

However I am afraid the computer cannot be of aid in the "interpersonal relationship between the physician and the patient," as Hoffmann puts it, unless of course we stretch a point and say that any assistance a computer may give the physician in making a more precise diagnosis and a more scientific determination of the plan of treatment will tend to improve physician-patient relationships in general.

ROBERT S. LEDLEY

National Academy of Sciences—National
Research Council, Washington, D.C.

Cardiotachometer

In a report by Rowley, Glogov, and Stoner published in *Science* [**130**, 976 (1959)], entitled "Measurement of human heart rate during usual activity," the authors stated, "Quantitative data on heart rate in beats per many minutes to many hours during various kinds of activity and work are not available."

It is apparent that the authors are unfamiliar with past developments in this field. In 1929, the late Ernst P. Boas developed the "cardiotachometer," which was designed to take continuous records of the heart rate for periods of hours or days. The many papers relating to this development were summarized in a text, *The Heart Rate* (Thomas, Springfield, Ill., and Baltimore, 1932). Since that time the device has been used extensively in many countries of the world and has been incorporated in many diagnostic and research tools.

NORMAN F. BOAS

Research Division, Norwalk Hospital,
Norwalk, Connecticut

We should like to express our gratitude to Norman F. Boas for calling our attention to the outstanding work of the late Ernst P. Boas, who published a detailed description of his cardiotachometer in 1928 ["The cardiotachom-

eter, an instrument to count the totality of heart beats over long periods of time," *A.M.A. Arch. Internal Med.* **41**, 403 (1928)]. The instrument was about the size of a present-day electrocardiograph; precordial electrodes, held in place by straps encircling the chest, were connected to the cardiometer by long lead wires.

The miniature heartbeat counter described by us in *Science* is completely self-contained and will permit epidemiologic studies which were not possible with the cardiometer developed by Boas.

DONALD A. ROWLEY
SEYMOUR GLAGOV
PETER STONER

Department of Pathology, University
of Chicago, Chicago, Illinois

Metric System

The American Geophysical Union's Special Committee for the Study of the Metric System in the United States noted your publication of our letter to the editor and its accompanying questionnaire [*Science* **129**, 532 (27 Feb. 1959)]. The committee appreciates your presenting this matter to your readers. It wishes, also, to thank the readers who aided the committee by a generous return of completed questionnaires. Many of the replies included letters containing helpful suggestions and offering financial assistance.

In the September 1959 *Transactions of the American Geophysical Union* your readers will find a full report of the committee, together with an analysis of the replies to the questionnaire received as of July. At this writing, three months later, 1080 have been analyzed. The fields of science and engineering were quite well covered by publication of the letter or questionnaire, or both, in eight leading journals and magazines in the United States. In reply to the most significant question, as to whether it would be desirable to replace the English system by the metric as the "only official system" of weights and measures in the United States, 90 percent replied in the affirmative. The average period of transition suggested was about 22 years; this indicates agreement with the committee on the necessity for a long transition period to avoid economic dislocation. Such a transition period would permit time for education in the schools, normal retirement of presently active older personnel, and normal obsolescence of existing equipment.

The Congress of the United States, for the first time in nearly 30 years, is faced with a decision in this matter. House bill HR7401, introduced last

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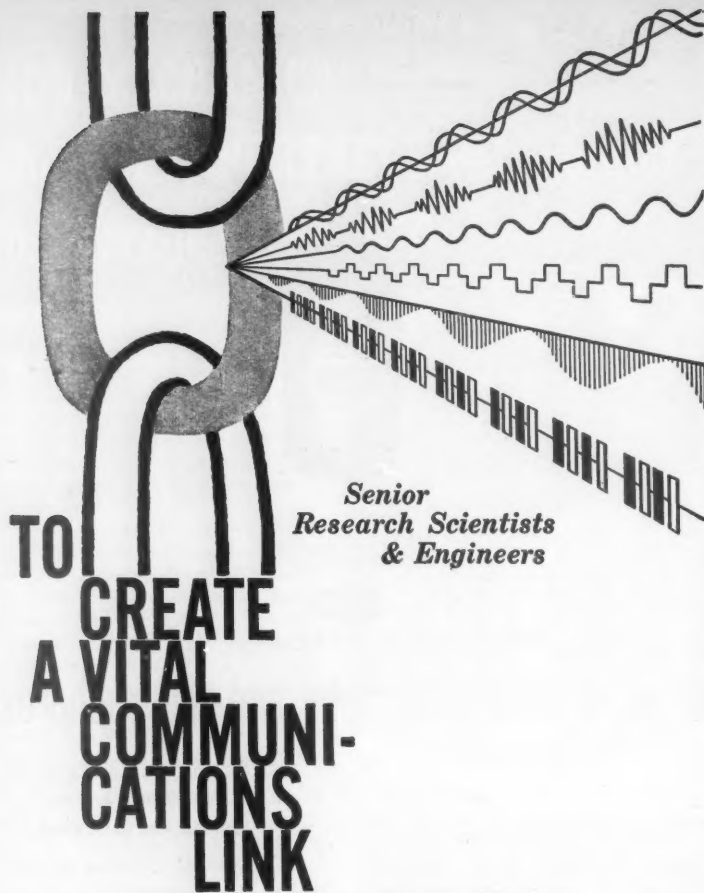
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May by Representative Brooks of Louisiana, and Senate bill S2420, introduced in July by Senator Neuberger, both call for a feasibility study of the problem by an appropriate government agency, with authorization of funds. Also of interest was the introduction in July 1959, by Representative Fulton, of House Concurrent Resolution 364, which would place Congress on record as favoring adoption of the metric system.

It is apparent that the United States must soon decide whether to change over gradually, during the next generation, to a far simpler and more logical system of weights and measures or to continue to be counted with the remaining 10 percent of the world's population that is not yet under the metric system.

Note added in proof. A revised report on the larger number of questionnaires is contained in the December 1959 *Transactions of the American Geophysical Union*.

FLOYD W. HOUGH
Special Committee for the Study of the Metric System in the United States, American Geophysical Union

Time of Planet Formation

Reynolds (1) has recently observed high relative concentrations of Xe^{136} in the chondritic meteorite which fell in Richardton, N.D., in 1919. He correctly attributes this isotope to the decay of fossil I^{136} and derives a time of formation of the meteorite 3.5×10^9 years after element formation. This is to be compared to 2.7×10^9 years for the formation of the earth, according to Katcoff, Schaeffer, and Hastings (2), who base their calculations on data for terrestrial xenon, and to 3 to 5×10^9 years for the formation of the moon (3).

While in the article on the lunar atmosphere (3) several mechanisms were considered and three were selected as indistinguishable upon the basis of available information, the new data strongly support the I-Xe mechanism. It is therefore probable that the rare lunar atmosphere is nearly pure Xe^{136} .

The coincidence of these three ages gives strong support to the hypothesis that the planets were formed in a relatively short period, and to the Moulton and Chamberlain planetesimal hypothesis.

L. B. BORST

Department of Physics,
New York University, New York

References

1. J. H. Reynolds, *Phys. Rev. Letters* 4, 8 (1960).
2. S. Katcoff, O. A. Schaeffer, J. M. Hastings, *Phys. Rev.* 82, 688 (1951).
3. W. F. Edwards and L. B. Borst, *Science* 127, 325 (1958).

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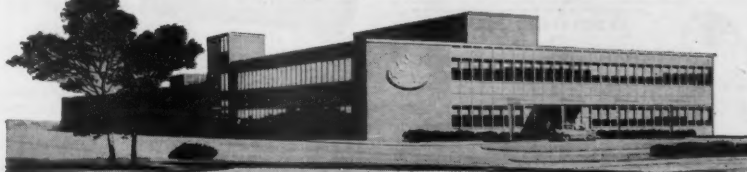
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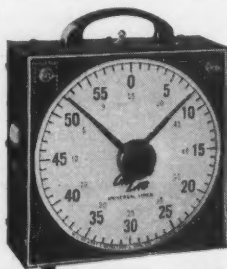
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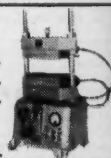
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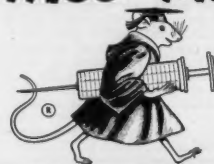
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NUCLEAR REVIEWS

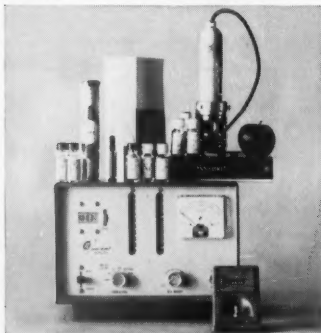
from
NUCLEAR-CHICAGO



ATOMS IN SCHOOL

Many colleges and universities are keeping step with the atomic age by providing training in nuclear techniques, but there are hundreds of colleges and thousands of high schools within whose ivied walls radioisotopes still go unrecognized officially.

To make nuclear training possible, practical and affordable to educators, Nuclear-Chicago now offers its brand new, complete, low cost Model 4000 Nuclear Training System. With this System chemistry, biology and physics instructors will find it easy to present dramatic and effective lecture and laboratory sessions on nuclear techniques, sessions which will snap the most lackadaisical class out of its bemusement with basketball or be-bop.



This Nuclear Training System includes a sensitive Geiger tube, a decade scaler, interval timer, sample mount and a Radionuclide Set containing eight different ra-

reagents, a micro-pipette, pipette syringe, and 100 stainless steel sample pans.

Although sufficient activity is supplied in each reagent so that a large number of experiments can be made, no AEC license is required to obtain or use the System or the reagents provided with it. We also supply a 144 Page manual of suitable radioisotope experiments reprinted from the JOURNAL OF CHEMICAL EDUCATION.

We have illustrated the complete set and our modest price for the whole works is only \$652.00. The apple in the picture is just to tempt you to write for our Bulletin No. 131 which describes the System in detail. If you would also like a copy of the Manual of Experiments, just ask for "Journal Reprints."

DOWN TO EARTH

If your job requires you to dig, build on or grow things in soil, it is important that you have a



pretty good idea of its characteristics. Two of the common questions asked about soil are "What is its density?" and "What is its moisture content?". To get answers has required procedures that are time consuming, expensive and inconvenient. Now Nuclear-Chicago's d/M-Gauge® System helps get the right answers in a fast, easy, modern way.

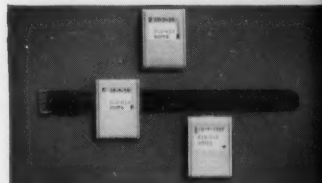
With the d/M-Gauge, moisture or density measurements can be made in a minute or two right on the spot. Surface probes provide measurements to a depth of 10 inches without moving a handful of soil. Depth probes, lowered

into a small diameter hole, give readings at any depth to 200 feet. Precise results are immediately available. No expensive and delaying laboratory analysis is needed. Measurements of moisture content or density are simply determined by applying the count per minute figures from the scaler to a calibration chart. It is all done with radioisotopes, but it doesn't take a nuclear engineer to work it. It is a simple economical method that anyone can use right in the field. Proved in the field for two years, we are sure it will be a boon to construction engineers, agronomists, farmers and anyone whose work keeps them down to earth. If you are concerned in any way with soil, it might be a good idea to read up on our d/M-Gauge System. Ask for our interesting brochure on it.

RADIATION CONTROLS

There is a lot of legislative activity on radiation controls these days. Most every state is adopting some kind of control and AEC and other government offices are revising regulations.

One thing we feel sure of though, ultimately we're all going to be pretty safe with so many people looking out for our welfare. In



the meantime, if you have anything to do with ionizing radiation of any kind, better get a good film badge service because records are going to be valuable. We feel our service is the finest—good accuracy, accumulative reporting, ultra-fast service, low cost. Write us for full information.

 **nuclear-chicago**
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